From: Barbara Ritchie <BARBARA.RITCHIE@fmc.com>
Sent: Tuesday, June 10, 2014 12:44 PM
To: Weigel, Greg
Cc: Hastings, Janis; Smith, Andy; 'Kelly Wright'; susanh@ida.net; Rob Hartman; brian.english@deq.idaho.gov; Al Lam; Mark Smith; Marc Bowman; Rochlin, Kevin; vannoyj@dhw.idaho.gov; Paden, Norka E - CO 6th; Brian McGinnis
Subject: Pond 15S and 16S RIWPs
Attachments: 2014-06-10 FMC Pond 15S Readily Implementable Work Plan.pdf; 2014-06-10 FMC Pond 16S Readily Implementable Work Plan.pdf

Greg,

As directed in your letter of May 23, FMC has prepared the attached Readily Implementable Work Plans (RIWPs) for gas extraction and treatment at Ponds 15S and 16S.

As we discussed and agreed in our conference call of Friday, June 6th:

1. The attached RIWPs have been highlighted to note the changes made to address your May 23rd letter. The Pond 15S RIWP was based on the 3/8/13 Readily Implementable Interim Work Plan for Pond 18A, and the Pond 16S RIWP should replace the 3/8/13 version of a Readily Implementable Interim Work Plan for Pond 16S (both of the 3/8/13 plans you approved 4/18/13).

2. We completed the Pond 16S June perimeter pipe monitoring on Monday, 6/9. Results for the north standpipe were above 10,000 ppm PH3 (12,647 ppm). As agreed, we have commenced preparation of the GETS for operation and anticipate beginning extraction on 16S tomorrow morning consistent with the attached work plan.

Once you have approved RIWPs for 15S and 16S, we will produce non-highlighted final hard copies for distribution per the UAO.

Any questions, please advise.

FMC Idaho LLC, Pocatello, Idaho

POND 16S
READILY IMPLEMENTABLE WORK PLAN
FOR GAS EXTRACTION AND TREATMENT

June 10, 2014

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APPENDIX

TABLE

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SECTION 1 INTRODUCTION

1.1 REQUIRED GAS EXTRACTION AND TREATMENT AT RCRA POND 16S

In a letter from EPA dated May 23, 2014 regarding Modification to Require Work Plans for Gas Extraction and Treatment and Additional Monitoring at RCRA Ponds 15S and 16S; CERCLA Unilateral Administrative Order for Removal Action, Docket No. CERCLA 10-2010-0170 ("UAO," effective July 12, 2010), EPA is requiring FMC to prepare "Readily Implementable Work Plans" for gas extraction and treatment at Ponds l5S and l6S that are required by June 10, 2014 such that they can be implemented within 48 hours upon approval. The Readily Implementable Work Plans must also include an air (surface scan and appurtenance) and perimeter pipe monitoring schedule and frequency that provides for more frequent monitoring when concentrations are rising or elevated above levels requiring the initiation of gas extraction and treatment, and for less frequent monitoring based upon falling concentrations.

1.2 SCOPE OF THIS WORK PLAN

The scope of this plan is to provide the Readily Implementable Work Plan for gas extraction and treatment at Pond 16S as directed by the May 23rd EPA letter. As gas extraction and treatment has previously been performed at Ponds 16S and 15S, separate Readily Implementable Work Plans have been prepared and submitted for each of these RCRA ponds which are consistent with earlier approved work plans.

This *Pond 16S Readily Implementable Work Plan* is largely based on the previously EPA-approved gas extraction and treatment system (GETS) design and operating procedures specified in the Pond 16S Interim Work Plan (for) Gas Extraction and Treatment (March 8, 2013).

1.3 PROJECT ORGANIZATION

The key personnel associated with the performance of the project described in this Pond 16S RIWP and associated responsibilities presented in the following subsections.

1.3.1 EPA On-Scene Coordinator

The EPA On-Scene Coordinator, as specified in the UAO, is Mr. Greg Weigel, of the Emergency Response Unit, Office of Environmental Cleanup, Region 10.

1.3.2 FMC Remediation Director

The FMC Remediation Director, Ms. Barbara Ritchie, is responsible for overall program implementation, quality and reporting. The Remediation Director is responsible for setting up and procuring the services and ensuring that FMC receives the quality and scope of work described in the contract documents. The Remediation Director is the only person with the authority to change the scope of the project, which is done through the process of change orders and contract modifications.

1.3.3 MWH Project Coordinator

The Project Coordinator will perform overall engineering oversight of the project. The Project Coordinator will interact and communicate directly with the FMC Remediation Director on a regular basis to ensure that the requirements of the contract documents are met and that regulatory issues relating to the UAO are addressed. The MWH Project Coordinator will be Rob Hartman.

1.3.4 KW Health and Safety Manager

The Health and Safety Manager (HSM) has overall responsibility for implementation and maintenance of the site Health and Safety Plan. The HSM is responsible for monitoring and assessing hazardous/unsafe situations, developing measures to assure personnel safety, maintaining the emergency response organization and equipment per the RCRA Contingency Plan, performing job planning safety analyses (JPSA) on job tasks, and training of employees commensurate with their responsibilities. The HSM is also responsible to ensure unsafe acts or conditions are corrected in a timely manner. The Health and Safety Manager is Mark Smith.

SECTION 2 SUMMARY OF PRIOR UAO ACTIONS AT POND 16S

The Pond 16S Removal Action Completion Report (Pond 16S RACR) submitted on December 2, 2010 describes prior gas extraction at Pond 16S in the period 2007 to 2010. As directed by EPA's April 16, 2013 letter directing FMC to commence implementation of the approved Pond 16S Interim Work Plan, gas extraction and treatment commenced at Pond 16S in April 2013 and was completed in July 2013. The GETS operational results, perimeter pipe, appurtenances and perimeter surface scan monitoring results since submittal of the Pond 16S RACR have been reported to EPA in monthly reports pursuant to the UAO.

SECTION 3 GAS EXTRACTION AND TREATMENT DESIGN AND OPERATION

3.1 APPROACH FOR GAS EXTRACTION AND TREATMENT

Based upon the gas extraction experience and success achieved during the 2008 through 2010 and again from April to July 2013, the readily implementable gas extraction and treatment system at Pond 16S will involve the re-initiation of operation of the GETS installed at Pond 16S in 2008. The purpose of this section is to describe the design and operation of the GETS and the overall approach for gas extraction and treatment at Pond 16S.

Section 3.2 provides a description of the design of the GETS. Section 3.3 provides the overall approach for re-start/operation of the GETS at Pond 16S for the gas extraction and treatment. Both of these sections have been updated to reflect the current system design and operation.

3.2 GETS DESIGN

The GETS design and operation is described below. These sections on the GETS design were taken from the following EPA-approved documents and reflect the GETS design at the time of the system shutdown in November 2010:

- *Pond 16S Final (100%) Design Analysis Report – August 2007*
- *Pond 16S Final (100%) Design Analysis Report – Addendum B – August 2008*
- *Pond 16S GETS Optimization and Operation Plan – October 2008*

3.2.1 Summary of GETS Operating Criteria

The GETS is designed to extract and treat gases from Pond 16S such that tailgas concentrations are at a level that is protective of human health and the environment. The primary operating criteria for the Pond 16S GETS are:

- Extraction flowrate of 0.2 to 10 cfm of gas per TMP.
- Maximum exhaust concentration of PH3 from the GETS $\leq$ 0.3 ppm with an action level of 0.2 ppm.
- Normal operating PH3 concentration entering the primary carbon vessel will be targeted at 300 ppm except under low ambient temperature air conditions or when the concentration of the source pond gas is below levels needed to achieve this target.

- Adequate air purge during the cool down phase of operation (i.e., when taking the carbon bed off-line due to the carbon being spent or as result of a planned or unplanned shutdown) to prevent carbon overheating.
- Maximum carbon vessel operating temperature = 250 degrees F.
- Operate the GETS such that gas concentrations from any other discharge point(s) in the system, do not exceed levels that are protective of human health and the environment (including workers and site visitors), even during system upset or maintenance conditions. Discharge point(s) for the GETS have been designed using best engineering practices to protect on-site workers from potential exposure to gases.
- The GETS will be operated so system malfunction or failure are detected and addressed in a timely manner.

3.2.2 Overall GETS Design Configuration

The GETS was designed and constructed in 2008 and is located on the northwest corner of Pond 16S. Since achieving the initial Pond 16S UAO performance objectives in November 2010 and achieving the UAO performance objectives in July 2013 following the second period of operation of GETS, the GETS has remained in-place and maintained to ensure that the system is still operational. The GETS is configured into three functional areas, the temperature monitoring points (TMPs), the blending and collection, and treatment. The process flow diagram for the GETS design is shown in Figure 3-1. The three separate functional areas are described in more detail below:

<u>TMPs</u> - There are a total of eight temperature monitoring points (TMPs) incorporated into the Pond 16S cover system. These eight TMPs are connected to an eductor powered by motive air supplied by a compressor. The eductor creates a vacuum to extract pond gas from the TMP well. The TMP gas is blended instantaneously within the eductor (initial dilution) to less than the PH3 LEL level, such that autoignition of the TMP gas typically does not occur. Normal operation consists of a 1:1 to 10:1 dilution of the pond gas, controllable by manual valves located at each TMP. The diluted TMP gas then flows to the collection area headers.

<u>Blending and Collection</u> - The blending and collection area consists of a north and a south header that collects mixed gas from TMP extractions (four TMPs per header). A primary fresh air blending inlet is provided at the end of each header to further dilute the mixed gas (primary dilution). The two headers then combine to a single gas stream before entering to the treatment system. A secondary air blending inlet is provided to the combined header to dilute the PH3 gas concentration to the inlet target of approximately 300 ppm PH3. Filters are provided at all dilution air inlets to limit moisture content, dust, and other foreign objects from entering the gas stream.

Treatment Area - In the treatment area, the diluted gas from the blending and collection area first passes through a condensate separator to remove liquids in the gas stream. In the current GETS design, the fan providing the motive force for the system is located immediately downstream of the condensate separator. After the fan, the gas passes through primary and secondary carbon vessels to remove the gases of concern (primarily PH3) and then discharges out the GETS stack to the atmosphere. The carbon vessels utilize Calgon Carbon's Centaur® technology to remove PH3 from the extracted pond gases. The Centaur® carbon converts the PH3 to non-toxic, strongly adsorbed phosphorus compounds.

3.2.3 GETS Control

The GETS is designed for manual control. Operators adjust and control TMP flow rates, motive gas flow rates, primary and secondary dilution flow rates in order to meet the operating criteria. The operating criteria are monitored using in-line flow, temperature and pressure instruments and hand-held PH3 monitors.

A safety interlock is incorporated into the system design to shut off all TMP source gas flow and provide for air purge when a high temperature in the combined header is encountered. In the event a carbon vessel high temperature is encountered, safety interlocks will shut off all TMP source gas flow, close the combined header valve, shut off the blower, and close the secondary dilution air valve and flushes the carbon vessels with nitrogen. Further information on the GETS operation is provided in the following subsection.

3.3 GETS Operation

Upon re-start, the GETS will be operated in accordance with operational parameters and procedures used at the time of system shut-down in November 2010. The key operating parameters and procedures are discussed below.

Note that all employees involved in the operation, maintenance, oversight, or supervision of the Pond 16S GETS operation must read, understand, and follow the guidance, procedures, and requirements as presented in the FMC Site-Wide Health and Safety Plan as well as their own company Health and Safety Plan. This will include but not be limited to the RCRA Pond Area Work Rules.

3.3.1 Normal Operating Conditions

During normal GETS operation, targeted operational parameters are as follows:

- The normal blended gas carbon vessel inlet feed rate is 2,200 cfm.
- The normal operating PH3 concentration entering the primary carbon vessel shall be about 300 ppm except under low ambient air conditions (see Section 3.3.3).

- Maximum outlet operating temperature from the primary carbon vessel shall be 250° F.

- When the PH3 concentration exiting the primary carbon vessel reaches 10-15 ppm, the primary carbon vessel shall be isolated and the carbon replaced. This is done by positioning the spectacle blinds such that the spare carbon vessel will be in the secondary carbon vessel position and the secondary carbon vessel is moved to the primary carbon vessel position. The carbon in the isolated carbon vessel (formerly the primary carbon vessel) can then be replaced.

- The discharge PH3 concentration from the secondary carbon vessel (tailgas) shall be less than 0.3 ppm during normal operation. Note that a discharge PH3 concentration of 0.2 ppm or more would indicate that the operator needs to take action, e.g., reduce the inlet PH3 concentration.

3.3.2 Tools and Equipment

- High range portable PH3 gas monitor. Draeger Pac III (or Draeger X-AM 5000) portable monitor calibrated for 0 to 1000 ppm range.

- Low range portable PH3 gas monitors. Draeger Pac III (or Draeger PAC 7000) portable monitor calibrated for 0 to 20 ppm range for monitoring low concentrations of PH3.

- Tools and equipment necessary to check and replace instrumentation.

- Parts and tools to perform maintenance on the fan, carbon vessels, piping and instrumentation.

- Tools and equipment necessary to change carbon vessels and to replace carbon, including wrenches, fittings, and spectacle blinds to re-configure carbon vessel piping.

- Safety glasses, gloves, and other required PPE

- Cell phone

- ToxiPro A5.7 PH3 meter with a range of 0-20 ppm PH3 and alarms set at 0.3 ppm and 1.0 ppm (or equivalent monitor for personal protection).

- Fire extinguisher

3.3.3 Non-Routine GETS Operation

Inlet PH3 Concentration During Cold Weather

Historical operation of the GES units has demonstrated safe and efficient operation at a nominal PH3 concentration of 300 ppm to the inlet of the primary carbon drum. However, PH3 breakthrough across the GETS primary carbon vessel has been observed with inlet concentrations of 300 ppm when inlet temperatures were below 50ºF (typically ambient temperatures below 0 ºF). As low ambient temperatures (and thus low inlet temperatures) are suspected to be the root cause of carbon issues experienced under these conditions, the current GETS procedure involves adjusting (lowering) the PH3 inlet concentration when inlet temperatures are below 50ºF.

During normal operation (and inlet temperatures at or above 50 ºF), the inlet PH3 concentration target is 300 ppm. When the primary carbon vessel inlet temperature drops below 50ºF, the operator will reduce the inlet PH3 concentration to approximately 100 ppm. This will be accomplished by adjusting TMP extraction rates (and/or by turning off some TMPs). If the primary carbon vessel temperature drops below 40ºF, all TMPs will be shut off (eliminating PH3 in the inlet) and the system will operate on the fan only. This procedure is designed to avoid an imbalance in PH3 adsorption and PH3 reactions that apparently occur at low ambient (and therefore low carbon bed) temperatures. The fan will remain running during this period and TMPs will be brought back on line when the primary carbon vessel inlet temperatures reach 50ºF and higher.

Normal GETS Shut Down and Cool Down

Normal GETS shutdowns include shutdowns for maintenance, carbon change outs, or other planned shutdowns. The normal GETS shutdown procedure will include an air purge to ensure completion of the PH3 reaction and minimize N2 purging. For a normal shutdown, the fan will remain operating for a minimum of 4 hours after gas from the TMPs has been shut off. This purge time will be determined based upon operating experience and may be a function of ambient temperature. There will be no N2 purge used during a normal shutdown procedure, unless evidence of a carbon fire is present (such as excessive heating of the carbon vessel or outlet gas). Also, when possible, planned GETS shutdowns and startups will be performed only when ambient temperatures allow for primary carbon vessel inlet temperatures of 50ºF or greater (taking into account the temperature gain through the fan), to minimize the impact of colder temperatures on the rate of PH3 reaction on the carbon.

Upset/Emergency GETS Shut Down

Upset or emergency GETS shutdowns include (but are not necessarily limited to) shutdowns for high outlet temperatures or high PH3 concentrations at the tailgas. Shutdown procedures for each case are described below:

- In the case of high carbon vessel outlet temperatures (> 250ºF, indicating a possible excessive exothermic reaction in the carbon), the procedure will remain the same as before, i.e., the fan will automatically be shut down and the system will be purged with N2 for a minimum of 40 minutes.
- In the case of high PH3 in the tailgas (> 0.3 ppm), the TMPs will be immediately shutdown, but the fan will remain running for a minimum period of 4 hours to ensure the PH3 reaction is taken to completion. This may be altered (e.g., N2 introduced) if PH3 tailgas concentrations remain high or if overheating of the carbon is suspected (as evidenced by smoke at the discharge stack or excessive outlet temperatures). If the tailgas PH3 concentration remains above 0.3 ppm after shutdown of all TMPs, whether purging with N2 or with the fan running, tailgas discharge to the GES procedure will be implemented.

Power Outage (Electrical Backup)

In the event of a short duration power outage (< 20 minutes), an N2 purge of the GETS will not be automatically initiated. The operator will monitor the temperature of the GETS carbon vessels to ensure overheating is not occurring and manually initiate a nitrogen purge, only if needed based on excessive heating in the carbon units or visible smoke from the GETS stack. Once power is restored, the fan will be started and the system will be purged with air using the fan for a minimum period of 4 hours prior to re-introducing PH3 into the system. In the event of a longer duration power outage (> 20 minutes), the auxiliary diesel generator will start automatically to provide power to start the fan. Air will be purged through the carbon vessels for the duration of the power outage. Once power is restored, the GETS will be brought back online using line power, with a minimum period of 4 hours of air purge prior to re-introduction of PH3 to the system. Nitrogen purge through the GETS will only be used in the event of excessive heating of the carbon vessel or visible smoke at the discharge stack) which threatens the carbon, GETS equipment, or a release from the GETS.

Tailgas Discharge to the GES

There have been two instances during the initial GETS operation in which carbon overheating led to N2 purge of the carbon vessels. In these instances, N2 was used to purge at a rate of 50 acfm through the primary and secondary carbon vessel and out the discharge stack. Experience has shown that once N2 is used for carbon purging, the PH3 to H_3PO_4

reactions are greatly reduced or stopped such that resumption of the adsorption and decomposition reactions was difficult to re-establish without process upset.

To prevent potential releases of PH3 under these circumstances, e.g., after a N2 purge was initiated, a procedure will be implemented to divert the purge gas from the carbon vessels to a GES unit, instead of to the discharge stack. A flexible hose will be used to connect the GES to the GETS at a collection point between the primary and secondary carbon vessels. The GES fan will be used to draw the purge gas through the GES where the carbon in the GES will reduce the PH3 concentration to below 0.3 ppm prior to discharge to the atmosphere. Purging through the GES will continue until PH3 levels in the purge gas are below 0.3 ppm.

Spent Carbon Management

The Calgon Centaur® carbon is designed to adsorb PH3 gas and to react the adsorbed gas to phosphoric acid (H_3PO_4). Once carbon in the primary carbon vessel is utilized to the extent practicable (as evidenced by sustained breakthrough of PH3 through the primary carbon vessel), the primary carbon vessel will be isolated, the secondary carbon vessel will be positioned to the primary position and the in-line spare vessel to the secondary position. This is accomplished by shutting off the TMPs, purging with air for a minimum of 4 hours, and allowing the PH3 concentration in the inlet and the tailgas to reach 0.0 ppm. This purge time will be determined based upon operating experience and may be a function of ambient temperature. There will be no N2 purge used during the normal shutdown procedure, unless evidence of a carbon fire is present (such as excessive heating of the carbon vessel/outlet gas or visible smoke at the discharge stack). Then the fan is shut down and the piping configuration is manually adjusted for the new carbon vessel configuration, thus isolating the carbon vessel with the spent carbon. This carbon change-out procedure will remain as described previously in the *Pond 16S GETS Final (100%) Design Analysis Report – October 2007*.

At the time the spent carbon vessel (isolated at the inlet and outlet by means of blind flanges) is ready for carbon replacement, a nozzle is provided to allow for measurement of PH3 within the vessel. If PH3 is measured within the vessel at a level of 0.3 ppm or higher, this sealed spent carbon vessel will then be slowly purged with nitrogen or air with the discharge being processed through the primary and secondary carbon vessels (or GES unit) until the PH3 level measured at the outlet of the spent carbon vessel is again below 0.3 ppm.

If the PH3 level measured within the spent carbon vessel is below 0.3 ppm, the carbon replacement will proceed by removing the spent carbon and replacement with new carbon. The removed spent carbon will be placed in a container awaiting waste determination and final disposition. The head space of this spent carbon container will also be measured for PH3 once per batch after all the spent carbon has been placed in the container.

TMP Autoignition

The GETS is designed to extract high concentration PH3 gas from within the Pond 16S cover system and dilute this gas with ambient air to a concentration that can be safely treated in the carbon vessels. As PH3 at concentrations over the LEL (approximately 20,000 ppm) can autoignite when contacting air, the dilution of pond gas to below the LEL is a critical step in the GETS process. Each TMP is equipped with an eductor that provides the vacuum to extract the gas from the TMP and allow for the initial, nearly instantaneous dilution in a manner that generally inhibits autoignition. However, at times an autoignition of PH3 within the eductor does occur. An autoignition within the eductor can occur at any time, but usually occurs at higher PH3 concentrations, during hot ambient temperatures, and/or during operator adjustment of the manual control valve at the TMP. When an autoignition occurs, the PH3 reacts with oxygen in the dilution air to form P_2O_5 and H_3PO_4. This occurs entirely within the TMP piping and does not create a release to the atmosphere. However, the exothermic reaction immediately heats up the eductor and eductor gas such that the temperature sensor shuts off flow of pond gas from the TMP, thus stopping the autoignition.

The manual control valve at each TMP must be adjusted as part of normal GETS operation to set the PH3 extraction rate and thus the PH3 concentration being fed to the north and south header pipes. As indicated above, autoignitions can occur while the operator is making an adjustment to the manual valve at the TMP and as such, the operator will recognize the autoignition by the temperature increase. The operator will then attempt to restart the TMP following the procedure outlined below. If the operator is not present, i.e., the autoignition occurs on its own, the operator will be notified that the autoignition has occurred and that the TMP is shut off. The operator must then manually bring the TMP back on line following the same procedure as outlined below.

1. The operator will manually close the TMP adjustment valve. The TMP solenoid shut-off valve is typically in the closed position.
2. Once the TMP eductor has cooled, the operator will reopen the TMP solenoid shut-off valve. The operator will then slowly open the adjustment valve to introduce PH3 to the eductor.
3. If an autoignition doesn't occur, the TMP is brought on-line, the flow is adjusted and the TMP is operated normally.
4. If an autoignition does occur, the adjustment valve is immediately closed and the TMP is allowed to cool for several minutes. The process is then started over.

5. If after several attempts, autoignition persists when opening the control valve, the TMP will be taken off-line. Other TMPs will then be brought on-line or adjusted to achieve the desired carbon treatment inlet PH3 concentration.

6. The TMP eductor with the persistent autoignition problem will be disassembled. The eductor and piping will be washed using water to remove any buildup of H3PO4. Wash water is collected, characterized, and disposed as appropriate.

7. Once the TMP eductor and piping is washed, the eductor is reassembled and the process will be repeated. Typically, cleaning the eductor will correct the autoignition problem.

TMP Clearing

As has been experienced on Ponds 16S and 15S when extracting from TMPs, the TMPs can become flow restricted as result of a quantity of sand pack material (used during TMP installation) plugging the bottom of the TMP. This is typically observed as a high vacuum pressure (above 60 inches) at the TMP resulting in dropping extraction flow and PH3 concentrations. If several TMPs become flow restricted, this can cause limitations on PH3 mass removal and inefficient GETS operation, e.g., unable to maintain inlet PH3 concentrations at 300 ppm. A TMP cleaning/drilling procedure was developed at Pond 16S during initial operation and further improved on Pond 15S to allow for the safe removal of the sand pack material and drilling through the bottom of the TMP casing in order to re-establish flow at the plugged TMP. This procedure was approved by EPA in an email dated May 31, 2012. The TMP Mechanical Drilling Procedure (Updated May 24, 2012) is included as Appendix A.

Carbon Replacement

When the PH3 concentration exiting the primary carbon vessel reaches 10-15 ppm, the primary carbon vessel shall be isolated and the carbon replaced. This is done by positioning the spectacle blinds such that the spare carbon vessel will be in the secondary carbon vessel position and the secondary carbon vessel is moved to the primary carbon vessel position. The carbon in the isolated carbon vessel (formerly the primary carbon vessel) can then be replaced.

Newly installed carbon requires “conditioning” before reaching the maximum treatment capacity. Experience has shown that each batch of carbon may require different periods of conditioning. During the initial conditioning period, the inlet concentration shall be reduced to ensure GETS tailgas emission is within the acceptable limits. The discharge PH3 concentration from the secondary carbon vessel (tailgas) shall be less than 0.3 ppm during normal operation. Operators shall observe the second vessel discharge concentration and adjust the TMP inlet flowrate accordingly. An action level shall be set at 0.2 ppm PH3 in the GETS tailgas, i.e., action will be required if the tailgas concentration reaches 0.2 ppm PH3. Actions may be reduction in pond gas flowrate to the treatment system thus reducing the PH3 concentration to the treatment system, or ultimately shutting off all TMP gas to the system.

3.3.4 Operational Monitoring

The operation parameters to be monitored during operation of the Pond 16S GETS are described as follow:

1. PH3 concentrations (measured with a hand-held PH_3 monitor) are measured at locations as shown on Figure 3-2:

    a. At the end of north and south collection headers - This measurement indicates the north or the south side collection header diluted gas concentration (each isolated from each other). The isolation of the north and south side allows the system to be diagnosed easily without sacrificing total treatment capacity. For example, the system can be set to operate primarily from the south side collection header while operating the north side TMPs one at a time for evaluation (e.g. determination of TMP gas PH3 concentration, short-circuiting, etc.). Hand-held PH3 monitors (Draeger Pac III [or X-AM 5000 / Pac 7000]) portable monitor calibrated for 0 to 1000 ppm, and 0 to 20 ppm PH3) are used for this monitoring.

    b. At inlet to primary carbon adsorption vessel – This measurement is used to maximize PH3 treatment through the carbon vessels. The target inlet PH3 concentration is 300 ppm. The inlet PH3 concentration is controlled by adjusting the total TMP extraction flowrates and primary air dilution flow rates while fine-tuning by adjusting the secondary air dilution flowrate. Hand-held PH3 monitors (Draeger Pac III [or X-AM 5000 / Pac 7000]) calibrated for 0 to 1000 ppm or 0 to 20 ppm PH3 are used for this monitoring.

    c. At the exit from primary carbon vessel – This measurement is used to compare with inlet PH3 concentration to determine the carbon performance (treatment efficiency, breakthrough, etc.) of the primary carbon vessel. Hand-held PH3 monitors (Draeger Pac III [or Pac 7000]) calibrated for 0 to 20 ppm PH3 are used for this monitoring.

    d. At exit from secondary carbon vessel (GETS tailgas) – This PH3 measurement is used to ensure that discharge to atmosphere is less than 0.3 ppm. As indicated above, a discharge concentration of 0.2 ppm will require action on the part of the operator to bring the discharge PH3 concentration down. Hand-held PH3 monitors (Draeger Pac III [or Pac 7000]) calibrated 0 to 20 ppm PH3 are used for this monitoring.

During normal operational periods, tailgas monitoring will be conducted three times per operating shift. Normal operational periods are those during which the system is operating steadily at the intended capacity. These are periods when it would be expected that the GETS is performing relatively consistently over time.

During non-routine operational periods, e.g., after a carbon changeout and the new carbon vessel is brought on-line, tailgas will be monitored more frequently until the carbon is determined to be conditioned. During non-routine operational periods such as after a carbon change-out, operators will make correctional adjustments to the process if any tailgas reading exceeds 0.20 ppm PH3. This "action level" provides a buffer of another 50 percent increase in discharge concentration before reaching 0.3 ppm PH3.

2. Flow rates (venturi flowmeters, pitot tube flowmeters, and rotameters are used at various locations):

   a. At each TMP outlet, a venturi flowmeter is used to measure the flowrate of TMP gas being extracted and entering the system. Temperature and pressure of gas stream is also measured and used to correct the flow to scfm. This measurement is used to determine total extracted flow from the pond. Due to the change in TMP gas flowrate over the life of the project (i.e., low flow during the high PH_3 concentration phase to high flow during the low PH_3 concentration phase) several different venturi flowmeters are expected to be used.

   b. North and south collection headers are equipped with a pitot tube-type flowmeter. Temperature and pressure of gas stream is also measured and used to correct the flow to scfm. This measurement is also used to calculate north and south header average source gas concentrations.

   c. Upstream of condensate separator, a pitot tube-type flowmeter is used to measure the total flow of diluted TMP gas into the treatment system. This flow rate is corrected to scfm using in-line temperature and pressure measurements. This measurement is used to calculate pond gas PH3 concentration estimates.

   d. Eductor motive air at each TMP is measured by a rotameter. The motive air provides the initial dilution of the pond gas to ensure that the PH3 concentration is always below the LEL.

3. Temperature (in-line temperature measurements are used for flow rate correction calculations and to monitor equipment operation):

   a. Downstream from the TMP eductors to monitor for autoignition.

   b. Inlet and outlet of primary and secondary carbon vessels to adjust PH_3 inlet concentration for optimum carbon treatment, for possible excessive carbon exothermic reactions, and for treatment performance.

4. Pressure (in-line pressure measurements are used for flowrate corrections and system performance monitoring):

   a. Inlet and outlet of primary carbon vessel to monitor possible pluggage of the carbon bed.

5. Tank levels:

   a. Condensate tank level monitored by sight glass for condensate removal.

   b. Nitrogen cylinder(s) level (gauged by pressure) to ensure adequate inventory and for reordering purposes.

3.3.5 Data Analysis

Using the process monitoring data as described above, the following operation performance will be evaluated (or estimated by calculation).

Average Source Gas Concentration

The average source gas (gas extracted from the TMPs) PH3 concentration will be calculated from the inlet concentration, inlet flowrate, and total TMP extraction flowrate, i.e., equal to the product of concentration at the inlet to primary carbon adsorption vessel and flowrate upstream of condensate separator divided by the sum of all active TMP extraction flowrates.

3.3.6 Pond 16S GETS Operation

Operation of the GETS at Pond 16S will be consistent with prior successful extraction and treatment at Pond 16S. Specifically,

- Begin gas extraction and treatment at Pond 16S using the GETS extracting from TMPs within 10 days after EPA approval of this Work Plan and EPA direction to commence gas extraction pursuant to the approved plan. Initially, the GETS will be operated on a 12-hour per day, seven days a week (12/7) schedule.

- Implement (or continue to implement) the PH3 monitoring at 16S as described in Sections 3.3.4, 4.1 and 4.2.

The GETS connected to the Pond 16S TMPS, operating on a 12/7 schedule will achieve a minimum monthly-averaged PH3 mass removal rate of 15 pounds per day (lb/day) provided the source gas PH3 concentration remains above 8,000 ppm.

The operation of the GETS may be modified over time, based on monthly review of the monitoring data, to increase or decrease the monthly-averaged daily PH3 mass removal rate to maintain the perimeter pipe concentrations below 10,000 ppm. In addition, decreasing the monthly-averaged daily PH3 mass removal rate may be necessary to maintain efficient GETS operation, e.g., maintain 300 ppm inlet PH3 concentrations. Gas extraction at one or more of the Pond 16S perimeter pipe standpipes may be initiated using GES units in addition to or instead of GETS operation. Any GES units deployed to Pond 16S would be operated pursuant to the procedures and monitoring specified in the Pond 15S Readily Implementable Work Plan (June 10, 2014). The rate of PH3 removal from Pond 16S may be decreased by reducing the operating time of GETS or by replacing GETS operation with one or more GES units extracting from the perimeter pipe. FMC will notify EPA and obtain EPA approval prior to decreasing the GETS operating schedule and/or deploying GES units at Pond 16S.

Should the monthly perimeter pipe standpipe PH3 concentrations at all four (4) standpipes decrease below 2,000 ppm as measured using the dilution box method specified in Section 4.3.2.2, FMC will notify EPA and cease gas extraction and treatment at Pond 16S. Monitoring will continue pursuant to the then-applicable EPA-approved plan (e.g., this Readily Implementable Work Plan or an amended RCRA Pond Post-Closure Plan).

3.4 WASTE MANAGEMENT

Based upon experience with the existing gas extraction and treatment systems, generation of the following solid wastes are anticipated for the Pond 16S GETS installation and operation:

- Spent carbon;
- Condensate;
- TMP packing sand generated during TMP cleaning/drilling; and
- Construction and maintenance debris.

These anticipated solid waste streams are discussed below.

Spent Carbon

Approximately 7,500 pounds of spent activated carbon is anticipated to be generated each time the carbon is replaced in a carbon vessel. The point of generation of this waste stream will be upon removal of the spent carbon from the carbon treatment vessels. Based upon testing, process knowledge, and experience with the existing gas extraction and treatment systems, the spent carbon is not anticipated to be a hazardous waste per 40 CFR Part 261. However, a periodic waste determination will be performed and documented per 40 CFR § 262.11.

Condensate

Condensate may be generated during operation of the GETS. While dependent on ambient temperature, the point of generation of this waste stream will be upon removal of the condensate from the eductors and/or condensate separation vessel. Based upon testing, process knowledge, and experience with the existing gas extraction and treatment systems, the condensate is not anticipated to be a hazardous waste per 40 CFR Part 261. However, a periodic waste determination will be performed and documented per 40 CFR § 262.11.

TMP Packing Sand

Varying amounts of packing sand may be removed from TMPs using the TMP cleaning/drilling procedure. The amount of TMP packing sand generated will be dependent on the number of TMPs that must be cleaned, but generally a small amount, i.e., 1 to 10 pounds per TMP cleaned. Based upon previous testing, process knowledge, and experience with the existing gas extraction and treatment systems, the packing sand is not anticipated to be a hazardous waste per 40 CFR Part 261. However, a periodic waste determination will be performed and documented per 40 CFR § 262.11.

Maintenance Debris

Varying amounts of maintenance debris is anticipated to be generated from the operation of the GETS. The point of generation of these waste streams will be upon the point of disposal. Although these wastes are not anticipated to be hazardous per 40 CFR Part 261, a waste determination will be performed and documented per 40 CFR § 262.11 with the initial generation of each waste category, i.e., packaging materials, replaced equipment, sampling/monitoring wastes, spent PPE, etc.

Wastes that have been determined to be non-hazardous per 40 CFR § 262.11 will be either disposed on site or transported offsite for recycle or disposal. Wastes that are determined to be hazardous per 40 CFR § 262.11 will be managed in accordance with the regulatory requirements of 40 CFR Part 262, 265, and 268 including but not limited to:

- Land disposal restrictions per 40 CFR Part 268;
- EPA identification number per 40 CFR Part 262.12;
- On-site hazardous waste accumulation (storage) per 40 CFR § 262.34(d);
- If the waste is placed in containers, the requirements of 40 CFR Part 265 Subpart I;
- If the waste is placed in tanks, the requirements of 40 CFR 265 Subpart J (tank requirements):
- At closure, the storage area is closed per the requirements of 40 CFR § 265.111 and 40 CFR § 265.114;
- Preparedness and prevention requirements of 40 CFR Part 265 Subpart C;
- Contingency plan and emergency response requirements of 40 CFR Part 265 Subpart D;
- Training requirements of 40 CFR § 265.16;
- Satellite accumulation requirements of 40 CFR § 262.34(c);
- Manifesting off-site shipments of hazardous per 40 CFR § 262.20; and/or
- Reporting and recordkeeping per 40 CFR § 262.40.

SECTION 4 MONITORING AND REPORTING

4.1 MONITORING UNDER THE AIR MONITORING PLAN

Monitoring pursuant to the Air Monitoring Plan as applied to Pond 16S per this RIWP will be performed at Pond 16S during and after ceasing gas extraction and treatment. A summary and schedule for the PH3 monitoring at Pond 16S is shown on Table 4-1. The monitoring will be performed following the procedures detailed in the Air Monitoring Plan (January 2011).

- Air Monitoring per the Air Monitoring Plan – Part I
    - Pond appurtenance air monitoring and leak detection at the 8 TMP enclosures, 2 ET cap drainage collection lift stations, 2 LCDRS sumps, 5 instrument panels and 4 standpipes at Pond 16S will be performed on a monthly basis upon commencement of and during gas extraction and treatment. Following ceasing gas extraction and treatment per the criteria in Section 3.3.6, appurtenance monitoring will revert to quarterly. If, based on quarterly perimeter pipe monitoring, the PH3 concentration in one or more standpipes is greater than 2,000 ppm, appurtenance monitoring will be performed monthly until the perimeter pipe PH3 concentrations return to below 2,000 ppm. When perimeter pipe PH3 concentrations are below 2,000 ppm, monitoring will be quarterly.

      After four (4) consecutive quarters of appurtenance monitoring, if there have been no detections of PH3 at or above 0.05 ppm of PH3 at any appurtenance, the frequency will be reduced to annually for Pond 16S unless the perimeter pipe PH3 concentration is above 2,000 ppm. The Pond 16S appurtenance monitoring locations are shown on Figure 4-1.

    - Pond perimeter surface scan monitoring will be performed at Pond 16S on a monthly basis, provided that required weather and/or ground surface conditions allow such monitoring during the month upon commencement of and during gas extraction and treatment. Following ceasing gas extraction and treatment per the criteria in Section 3.3.6, perimeter surface scan monitoring will revert to quarterly. If, based on quarterly perimeter pipe monitoring, the PH3 concentration in one or more standpipes is greater than 2,000 ppm, perimeter surface scan monitoring will be performed monthly until the perimeter pipe PH3 concentrations return to below 2,000 ppm. When perimeter pipe PH3 concentrations are below 2,000 ppm, monitoring will be quarterly. After four (4) consecutive quarters of cap perimeter surface monitoring, if there are no PH3 detections at or above 0.05 ppm of PH3 at the cap perimeter surface, this monitoring frequency will be reduced to annually on Pond 16S unless the perimeter pipe PH_3 concentration is above 2,000 ppm. The Pond 16S surface scan monitoring locations are shown on Figure 4-2.

  - Pond cap surface scan – if triggered by pond perimeter surface scan.
  - Low-lying areas – if triggered by monitoring listed in previous three sub-bullets.
- Air Monitoring per the Air Monitoring Plan – Part II
  - Continuous monitoring at two locations at Pond 16S. Continuous monitoring will be performed during periods when the GETS (and/or GES unit[s]) is extracting pond gas. The Pond 16S continuous monitoring station locations are shown on Figure 4-3.
  - Fenceline monitoring - if triggered by criteria set forth in the Air Monitoring Plan; and Off-site monitoring – if triggered by fenceline monitoring criteria set forth in the Air Monitoring Plan.

In addition to the above Air Monitoring Plan monitoring, inside appurtenance monitoring will be performed on the same frequency as the appurtenance air monitoring and leak detection monitoring. Note that there is no inside monitoring at perimeter pipe standpipes. The inside appurtenance monitoring will be performed following the procedures detailed in Section 3.4 of the Phosphine Assessment Work Plan – Final (July 2011). The TMP appurtenance monitoring procedure for Pond 16S will include leak detection monitoring of the GETS extraction piping components from the TMP enclosure to the solenoid valve at the Pond 16S TMPs as described in RCRA Pond UAO Weekly Report #114 (October 17, 2012).

4.2 GETS Area Monitoring

During GETS operation extracting pond gas from the TMPs, the GETS area process vessels, connection, valves, and the effluent stack will be monitored for PH_3 at least once per shift. GETS area monitoring during routine operation is described in Section 4.2.1 and monitoring during non-routine operations is described in Section 4.2.2.

4.2.1 GETS Area Monitoring During Routine GETS Operation

Real time PH_3 monitoring will be conducted while walking around the immediate GETS area. GETS area ambient air monitoring will be conducted continuously while walking around the perimeter of the system at a distance not exceeding 25 feet from the system. Monitoring will utilize a warmed-up, calibrated Dräeger Pac III (or Pac 7000) gas monitor (0 to 20 ppm range version), set in the operator's breathing zone while walking. The treatment system perimeter will be traversed at a comfortable walking speed or approximately 3 miles per hour. The PH_3-meter alarm will be set to sound if $\geq$0.20 ppm phosphine is detected. The operator will stop at the north, south, east, and west sides of the perimeter, for at least 1 minute, and record a stable reading in that location. The GETS area ambient air monitoring will typically be performed once per shift, preferably at times when winds are relatively calm. If PH3 alarms are observed during the GETS area monitoring perimeter walk, the location(s) will be flagged for further investigation and, when it's safe and advisable to do so, will attempt to locate, document, and remedy (if possible) the source of any elevated PH3 concentrations.

4.2.2 GETS Area Monitoring During Non-Routine GETS Operation

There may be periods of non-routine GETS operation when additional GETS area monitoring is warranted. These non-routine GETS operational periods include:

- Activities when unpurged GETS process piping or equipment is opened to the atmosphere such that PH3 could escape the atmosphere;
- Opening of unpurged carbon vessels to replace spent carbon; or
- Suspected leaking or venting of process gases.

During these non-routine operational activities, GETS area monitoring for PH3 will be performed as described in Section 4.2.1.

It should be noted that the standard procedure will be to purge the GETS with air and/or nitrogen prior to opening any process piping, vessel, or equipment to atmosphere. This procedure will be followed to purge any PH3 in the system through the carbon for removal to bring PH3 down to below 0.3 ppm. This purging will be confirmed by testing the tailgas at the end of the purging cycle and testing the process gases at the point of breaking open process piping, vessels or equipment. If this purging procedure is followed, then additional GETS area monitoring is not planned as emissions of PH3 gas above 0.3 ppm would not be expected.

For example, during a carbon change-out, the TMP gas will be shut off and the system allowed to purge with ambient air by drawing the dilution air through the carbon vessels using the system blower. Both the inlet to the primary carbon vessel and the discharge from the GETS system will be checked to ensure that PH3 concentrations are below 0.3 ppm prior to completing the system purging. Once purged with air, the spectacle blinds at the carbon vessels will be changed to place the in-line spare vessel to the secondary position, the second vessel to the primary position, and the spent primary vessel to the spare position. The system will then be brought back on line, using increased tailgas monitoring as outlined in Section 4.3.1.2 until the carbon is fully conditioned.

In addition to the GETS area monitoring during non-routine GETS operation described here, safety procedures require that personnel working in the area will have a personal PH3 meter to monitor PH3 concentrations in the area.

At the time the spent carbon vessel (isolated at the inlet and outlet by means of blinded flanges) is ready for carbon replacement, the door will be partially unbolted and slightly opened to allow for measurement of PH3 within the door. If PH3 is measured within the door at a level of 0.3 ppm or higher, the door will immediately be sealed and bolted up. This sealed spent carbon vessel will then be slowly purged with nitrogen with the discharge being processed through the primary and secondary carbon vessels until the PH3 level measured at the outlet of the spent carbon vessel is again below 0.3 ppm.

If PH3 level measured within the spent carbon vessel door is below 0.3 ppm, the carbon replacement will proceed by removing the spent carbon and replacing with new carbon. The removed spent carbon will be placed in a container awaiting waste determination and final disposition. The head space of this container will also be measured for PH3 once per batch after all the spent carbon has been placed in the container.

4.3 Pond 16S Perimeter Piping Gas PH3 Monitoring

During GETS operation extracting pond gas from the TMPs, the Pond 16S north perimeter gas collection pipe standpipe will be monitored monthly utilizing a GES unit until the north standpipe PH3 concentration is below 2,000 ppm, at which point, the other three (3) standpipes will be monitored to confirm all four standpipes are less than 2,000 ppm PH3. The sampling train calibration procedures are described in Section 4.3.1 and the perimeter pipe PH3 sampling procedure is described in Section 4.3.2.

Following ceasing gas extraction and treatment per the criteria in Section 3.3.6, perimeter pipe monitoring will revert to quarterly. If, based on quarterly perimeter pipe monitoring, the PH3 concentration in one or more standpipes is greater than 2,000 ppm, perimeter pipe monitoring will be performed monthly until the perimeter pipe PH3 concentrations return to below 2,000 ppm. When perimeter pipe PH3 concentrations are below 2,000 ppm, monitoring will be quarterly.

4.3.1 Sampling Train Calibration Prior to the Perimeter Piping Monitoring Event

Calibrate Draeger Pac III PH3 Monitor: The Draeger Pac III field monitor[1] (0 to 1,000 ppm) will have been calibrated with 500 ppm PH3 standard calibration gas within 14 days prior to any perimeter piping monitoring event.

Calibrate Sample Train Dilution Box: Also, within 14 days prior to any perimeter piping sampling event, the sampling train dilution box will be calibrated using 500 ppm PH3 standard calibration gas and using various dilution ratios (N2 to PH3) to confirm the accuracy of the dilution box.

To avoid release of PH3 to the environment, the PH3 calibration gas used in this calibration procedure will be collected in a Tedlar bag. The Tedlar bag will then be discharged to an operating GES or the GETS for treatment prior to release to atmosphere.

The perimeter piping sampling train calibration procedure follows:

1. Calibrate the Draeger Pac III PH3 monitor.
2. Position perimeter piping sampling train in the sampling lab. The equipment includes:
    - Gas dilution manifold
    - High-range (0 to 1,000 ppm) Draeger Pac III PH3 monitor equipped with a Draeger calibration cap.
    - Nitrogen gas cylinder for sample dilution
    - PH3 calibration gas cylinder (500 ppm)
    - Tedlar bag for the collection of gas discharged from the Draeger Pac III monitor.
    - Mass flow meters in the dilution manifold indicate the flow rate of calibration gas and dilution gas (nitrogen). The combined total flow of the PH3 calibration gas and any nitrogen dilution gas should be approximately 500 SCCM. This is the flow for which the Draeger Pac III calibration cap is designed.

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[1] Draeger has discontinued manufacturing the Pac III monitors but according to a Draeger representative they will continue to provide sensors and basic repairs for the Pac III. The Pac III is being replaced by the Draeger Pac 7000 for the low range PH3 sensor (0 – 20 ppm) and the by the X-AM 5000 for the high-range PH3 sensor (0-1,000 ppm). FMC may utilize the Pac III, Pac 7000, X-AM 5000 or equivalent monitors for the gas monitoring program.

3. Connect the nitrogen dilution gas to the designated flow meter on the dilution box.
4. Connect the PH3 calibration gas to the designated flow meter on the dilution box.
5. Connect the Draeger Pac III PH3 monitor (0 to 1,000 ppm range) to the discharge line from the dilution box.
6. Connect the exhaust tubing from the Draeger Pac III PH3 monitor calibration cap to the inlet port of a Tedlar bag. Open the inlet valve on the Tedlar bag.
7. Begin dilution box calibration by opening the valve to the PH3 calibration gas line only and start sampling using only calibration gas at a flow of approximately 500 SCCM. After the Draeger monitor reading has stabilized, record the base line PH3 concentration.
8. Repeat the previous step using both PH3 calibration gas and nitrogen dilution gas connected to the dilution box. Adjust the flow rates of both the PH3 calibration gas and nitrogen dilution gas to ratios of approximately 0.5:1, 1:1, 2:1, and 3:1. Record the flow rates. The total gas flow of PH3 calibration gas and nitrogen dilution gas should be approximately 500 SCCM (specified by Draeger for their PH3 monitors). Record the Draeger monitor PH3 concentration for each dilution ratio.
9. After the calibration is completed, close the valve to the PH3 calibration gas line and disconnect the line. Allow the nitrogen dilution gas to run until the sampling equipment has been purged into the Tedlar bag.
10. After the sampling equipment is purged, then close the valve to the nitrogen dilution gas and disconnect the line. Close the Tedlar bag inlet. (The contents of the Tedlar bag must be discharged back into an operating GES or the GETS system.)
11. Calculate the source gas concentration using data collected from Step 9.

    Calculated source gas concentration = (Draeger reading) x [(N2 flow + PH3 flow) / PH3 flow].

12. Compare the calculated source gas concentration with the baseline concentration and compute % error.

    Error = [(Calculated source gas ppm – Baseline ppm) / Baseline ppm] x 100

13. If the average % error is less than 5%, then the dilution box calibration is complete and the perimeter piping sample train is considered to be within acceptable tolerance limits.

4.3.2 Perimeter Gas Collection Piping PH3 Sampling Procedures

Perimeter piping sampling is to be performed in two steps. The first step is a screening level sampling to establish the screening level PH3 concentration and is based upon a calculation using operating parameters from the GES. The second level is to perform a more accurate PH3 concentration measurement using a direct gas sampling method, if the screening level is less than 10,000 ppm PH3.

4.3.2.1 Screening-Level Perimeter Piping Gas PH3 Sampling Procedure

This procedure is intended for initial screening of PH3 concentration in a RCRA Pond perimeter piping system when PH3 concentrations are unknown or known to be 10,000 ppm or greater.

1. As this procedure is used when perimeter piping gas PH3 concentration is unknown, it should be assumed that the PH3 levels are very high, i.e., the concentration is well above the concentration that is immediately dangerous to life or health (IDLH = 50 ppm) and possibly above the lower explosive limit (LEL = 20,000 ppm). Sampling personnel should wear a low-range (0 to 20 ppm PH3) monitor and complete all work in compliance with the *RCRA Pond Area Work Rules*. Approach the perimeter piping riser with a Draeger Pac III field instrument (0 to 20 ppm range) measuring ambient air PH3 concentrations. Check and record the PH3 concentration at the breathing zone (approximately 4 to 5 feet above the ground surface). Note that all RCRA pond TMPs are within the RCRA Pond Area and *RCRA Pond Area Work Rules* will apply to all persons entering this area. In addition, all personnel alarms will be recorded including the measurement reading and location (by GPS). An investigation will be performed and documented to determine, if possible, the source of the PH3 causing the alarm.

2. Connect the GES unit to the designated perimeter piping riser.

3. Start up the GES to the perimeter piping for at least three perimeter piping volumes turn-over using standard GES operating procedures. Note that the time necessary to extract one perimeter piping volume will be dependent on the PH3 concentration in the perimeter piping and total perimeter piping volume. The purge time will be determined for each pond during the initial purging operation. The GES should remain connected to the perimeter piping and operating during the sampling to provide the motive force for the extraction from the perimeter piping and treatment of extracted perimeter piping gas.

4. After purging the perimeter piping using the GES, the following operating parameters are measured or calculated and recorded from the operating GES:

- Gas flowrate from the perimeter piping standpipe
- GES total flowrate
- GES inlet PH3 concentration using the Draeger Pac III field instrument (0 to 1,000 ppm range)

5. From these recorded GES operating parameters, the perimeter piping gas PH3 concentration can be calculated as follows:

   Screening level perimeter piping gas PH3 conc. = (GES inlet PH3 concentration x total GES flow)/perimeter pipe standpipe flow

6. Repeat steps 3 and 4 to collect two additional screening-level perimeter piping gas PH3 concentrations. These measurements should be collected at least 10 minutes apart. Once the three screening level perimeter piping gas PH3 concentrations are calculated and recorded, average these three results and record.

7. If the average screening level perimeter piping gas PH3 concentration is greater than or equal to 10,000 ppm, it is considered too unsafe to attempt a direct sampling of perimeter piping gas (second-level sampling). The average screening level will be recorded as the perimeter piping PH3 gas concentration.

8. If the average screening level perimeter piping gas PH3 concentration is less 10,000 ppm, proceed to the second-level PH3 sampling procedure.

4.3.2.2 Second-Level Perimeter Piping Gas PH3 Sampling Procedure

This procedure is intended for use in measuring PH3 in pond perimeter piping gas that is known to be less than 10,000 ppm, based on the screening-level perimeter piping gas sampling. To avoid release of PH3 to the environment, the pond gas sampled during this procedure will be discharged directly to the Gas Extraction (GES) unit to avoid discharge of untreated pond gas to the atmosphere.

1. As this procedure is used when perimeter piping gas PH3 concentration is known, but still very high, i.e., the concentration is well above the concentration that is immediately dangerous to life or health (IDLH = 50 ppm), sampling personnel should wear a low-range (0 to 20 ppm PH3) monitor and complete all work in compliance with the *RCRA Pond Area Work Rules*. Approach the perimeter piping riser with a Draeger Pac III field instrument (0 to 20 ppm range) measuring ambient air PH3 concentrations. Check and record the PH3 concentration at the breathing zone (approximately 4 to 5 feet above the ground surface). Note that all RCRA pond TMPs are within the RCRA Pond Area and *RCRA Pond Area Work Rules* will apply to all persons entering this area. In addition, all personnel alarms will be recorded including the measurement reading and location (by GPS). An investigation will be

performed and documented to determine, if possible, the source of the PH3 causing the alarm.

2. It is assumed that the GES unit is already connected to the perimeter piping riser and was appropriately purged during the screening-level perimeter piping sampling. The GES should remain extracting during the sampling to provide the motive force for the extraction and treatment of extracted perimeter piping gas.

3. Position the perimeter piping gas sampling train and connect to the extraction gas using the couplings as provided at the sampling valve for sampling. The sampling train consists of the following:

   - GeoTech peristaltic sampling pump
   - Gas dilution box assembly
   - High-range (0 to 1,000 ppm) Draeger Pac III PH3 monitor(s) equipped with a Draeger calibration cap
   - Nitrogen gas cylinder for sample dilution
   - Discharge tubing connected to the dilution air inlet to the GES unit or a Tedlar bag for collection of the sampled gas

4. The gas dilution manifold should always be used in the perimeter piping gas sampling train. However:

   a) If the PH3 measurement from the perimeter piping is expected to be below 1,000 ppm (the limit of the high-range Draeger Pac III PH3 monitor), then the pond gas can be sampled directly through the dilution box without any dilution.
   b) If the PH3 concentration is expected to be above 1,000 ppm, then the pond gas will be diluted with nitrogen using the dilution box as appropriate to ensure the diluted sample PH3 concentration is below 1,000 ppm.

5. Mass flow meters in the dilution/mixing manifold indicate the flow rate of pond gas and dilution gas (nitrogen). The combined total flow extracted from the perimeter piping plus any dilution gas should be approximately 500 ml/min. This is the flow for which the Draeger Pac III calibration cap is designed.

6. Connect the suction side of the GeoTech sampling pump to the appropriate sampling port. Connect the discharge side of the GeoTech sampling pump to the designated dilution/mixing manifold mass flow meter (this is the pond gas containing PH3 to be measured).

7. Connect the nitrogen dilution gas, if required, to the designated flow meter on the manifold.

8. Connect the Draeger Pac III 0 to 1,000 ppm PH3 monitor properly to the discharge line from the dilution/mixing manifold.

9. Position the exhaust tubing from the Draeger Pac III PH3 monitor calibration cap to the inlet port of the dilution inlet of the GES. This will ensure the expelled gas is treated through the GES prior to discharge.

10. Begin sampling pond gas by opening the sampling valve to the perimeter piping sample train and start the sampling pump.

11. Adjust the flow rates of pond gas and the nitrogen gas (if needed) through the dilution/mixing manifold flow meters as required to meet the appropriate dilution ratio. The total gas flow of pond gas and nitrogen dilution gas should be approximately 500 ml/min (as specified by Draeger for their PH3 monitors).

12. Monitor the digital display of the Draeger Pac III PH3 monitor. When the PH3 readings have stabilized, record the Draeger monitor PH3 readings, the dilution/mixing manifold gas flow rates, the calculated dilution rate, and the calculated PH3 concentration corrected for any dilution.

13. Record 3 consecutive data sets, about 10 minutes apart. Record the data on the perimeter piping sampling log sheet. Calculate the average PH3 concentration from the 3 data sets.

14. After the sampling is completed from the perimeter piping, close the sample port valve and disconnect the sample hose. Allow the sample pump to run on fresh air until the sampling equipment has been purged into the dilution inlet port feeding the GES.

15. After the sampling equipment is purged, then turn off the sampling pump.

4.4 GETS Operation Monitoring

The GETS operation and source gas (TMP) monitoring that will be performed during gas extraction and treatment at Pond 16S is described in Section 3.3.4.

4.5 Data Analysis And Report Preparation

The GETS operational status and monitoring and operational data will be reported in the weekly/monthly UAO reports.

4.5.1 Report Content and Submittal

The operational status and monitoring activities will typically be reported in the UAO weekly reports. The weekly reports will include the following:

- Operational performance during the reporting week;
- Tabulated continuous monitoring data for the current week; and,
- Problems encountered and solutions proposed/implemented.

In addition to the above information, the monthly UAO reports will include:

- Monitoring results;
- Summary of process operational parameters; and,
- Operational objectives and any recommendations for changes to the GETS operating schedule and/or deployment and operating schedule of GES unit(s) during the upcoming month.

Table 4-1 Phosphine Monitoring Schedule for Pond 16S

<table>
<tr><th rowspan="2">Perimeter Pipe PH3 Concentration Range[1]</th><th colspan="4">Monitoring Program and Schedule</th><th rowspan="2">Response If Appurtenance AA and LD reading ≥ 0.05 ppm and/or Inside ≥ 1.0 ppm; and/or perimeter surace scan reading ≥ 0.05 ppm</th><th rowspan="2">Response If Inside Appurtenance Reading ≥ 10 ppm</th><th rowspan="2">Response If Appurtenance AA reading ≥ 0.30 ppm and/or LD reading ≥ 1.00 ppm and/or Inside Appurtenance reading ≥ 35 ppm</th></tr>
<tr><th>Appurtenances</th><th>Perimeter Surface Scan</th><th>Perimeter Pipe</th><th>Continuous Monitoring</th></tr>
<tr><td colspan="8">During Gas Extraction and Treatment</td></tr>
<tr><td>≥ 2,000 ppm</td><td>Monthly</td><td>Monthly</td><td>Monthly.
If extracting from perimeter pipe with GES, operational data - monthly average.</td><td>During periods of source gas extraction.</td><td>Perform maintenance and remonitor within 10 days and continue monitoring.</td><td>Perform maintenance and remonitor within 10 days and continue monitoring.</td><td>Perform maintenance and remonitor within 10 days.
If remonitoring reading > trigger levels, increase gas extraction PH3 mass removal rate.</td></tr>
<tr><td colspan="8">Post Gas Extraction and Treatment</td></tr>
<tr><td rowspan="3">< 2,000 ppm</td><td>Monthly</td><td>Monthly</td><td rowspan="3">Quarterly</td><td rowspan="4">Not applicable</td><td>Perform maintenance and remonitor within 10 days and continue monitoring.</td><td rowspan="3">Perform maintenance and remonitor within 10 days[2]. Perform perimeter pipe monitoring within 10 days. If perimeter pipe concentration in higher range, implement monthly monitoring.</td><td rowspan="4">Perform maintenance and remonitor within 10 days. Begin gas extraction and treatment within 10 days.</td></tr>
<tr><td>If prior 12 consecutive months, AA and LD ≤ 0.05 ppm, monitoring quarterly.</td><td>If prior 12 consecutive months, scan results ≤ 0.05 ppm, monitoring quarterly.</td><td>Perform maintenance and remonitor within 10 days[2] and continue monitoring. If post-maintenance result ≥0.05 ppm, revert to monthly.</td></tr>
<tr><td>If prior 4 consecutive quarters, AA and LD ≤ 0.05 ppm, monitoring annually.</td><td>If prior 4 consecutive quarters, scan results ≤ 0.05 ppm, monitoring annually.</td><td>Perform maintenance and remonitor within 10 days[2] and continue monitoring. If post-maintenance result ≥0.05 ppm, revert to quarterly.</td></tr>
<tr><td>2,000-9,999 ppm[3]</td><td>Monthly</td><td>Monthly</td><td>Monthly</td><td>Perform maintenance and remonitor within 10 days and continue monitoring.</td><td>Perform maintenance and remonitor within 10 days and continue monitoring.</td></tr>
</table>

Appurtenance AA means Ambient Air and LD means Leak Detection.

(1) Based on highest PH3 concentration standpipe for ponds with multiple standpipes.
(2) If the "within 10 day re-monitoring" outside appurtenance reading(s) are less than 0.05 ppm and the inside reading(s) are less than 0.3 ppm, then remonitor one month from initial exceedance (if on quarterly or annual monitoring frequency).
(3) If perimeter pipe concentration > 9,999 ppm, re-initiate gas extraction and treatment within 10 days.

SECTION 5 SUMMARY OF PLAN AND SCHEDULE

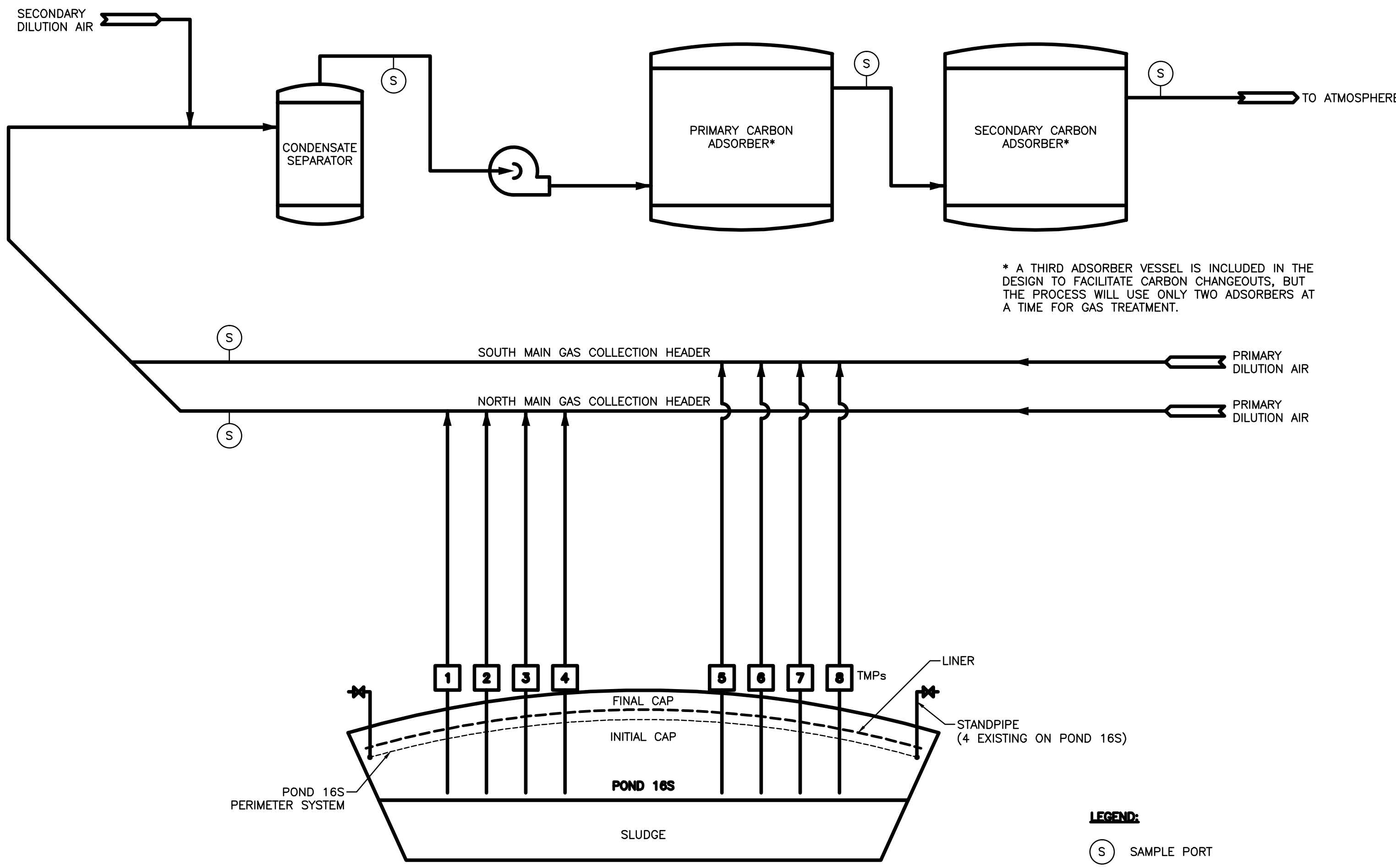
In summary, the readily implementable plan for gas extraction and treatment at Pond 16S is as follows:

- Begin gas extraction from the Pond 16S using the GETS within 48 hours after EPA approval of this Work Plan and EPA direction to commence gas extraction pursuant to the approved plan. Initially, the GETS will be operated on a 12/7 schedule.
- Implement (or continue to implement) the PH3 monitoring at Pond 16S as described in Sections 4.1 through 4.4 within 48 hours after EPA approval of this Work Plan and EPA direction to commence gas extraction pursuant to the approved plan.

As described in the Framework for Post-Closure Operation and Maintenance of RCRA Pond Gas Extraction and Treatment Systems (December 2012), the Pond 16S GETS operating on a 12/7 schedule will achieve a monthly-averaged PH3 mass removal rate of 12 pounds per day (lb/day) provided the source gas PH3 concentration remains above 8,000 ppm (with no significant flow restrictions).

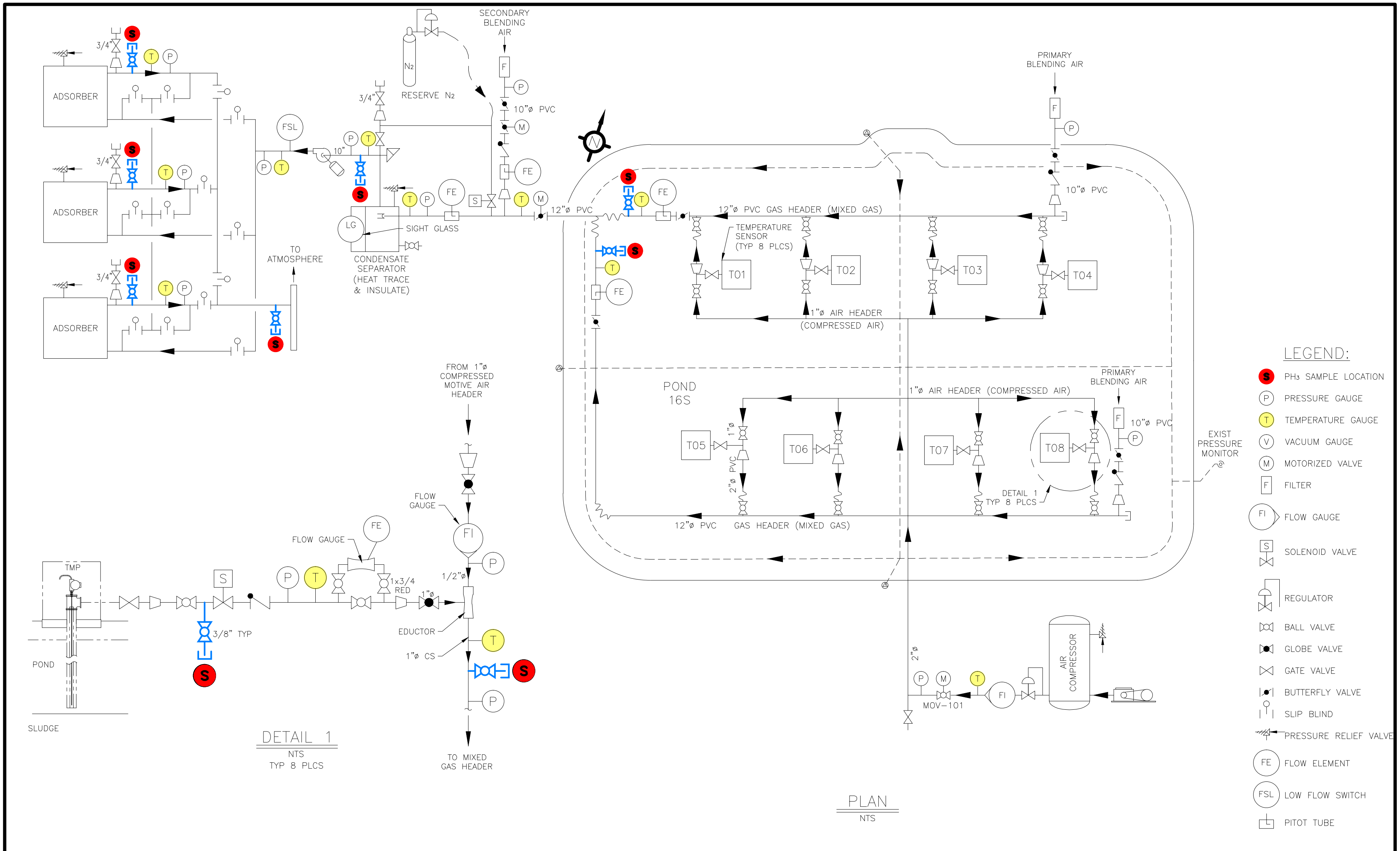
The operation of the GETS may be modified over time, based on monthly review of the monthly average monitoring data, to increase or decrease the monthly-averaged daily PH3 mass removal rate to maintain the perimeter pipe concentrations below 10,000 ppm. In addition, decreasing the monthly-averaged daily PH3 mass removal rate may be necessary to maintain efficient GETS operation, e.g., maintain 300 ppm inlet PH3 concentrations. Gas extraction at one or more of the Pond 16S perimeter pipe standpipes may be initiated using GES units in addition to or instead of GETS operation. Any GES units deployed to Pond 16S would be operated pursuant to the procedures and monitoring specified in the Pond 15S Readily Implementable Work Plan (June 10, 2014). The rate of PH3 removal from Pond 16S may be decreased by reducing the operating time of GETS or by replacing GETS operation with one or more GES units extracting from the perimeter pipe. FMC will notify EPA and obtain EPA approval prior to decreasing the GETS operating schedule and/or deploying GES units at Pond 16S.

When the monthly perimeter pipe standpipe PH3 concentrations at all four (4) standpipes decrease below 2,000 ppm as measured using the dilution box method specified in Section 4.3.2.2, FMC will notify EPA and may cease gas extraction and treatment at Pond 16S. Monitoring will continue pursuant to the then-applicable EPA-approved plan (e.g., this Readily Implementable Work Plan or an amended RCRA Pond Post-Closure Plan).



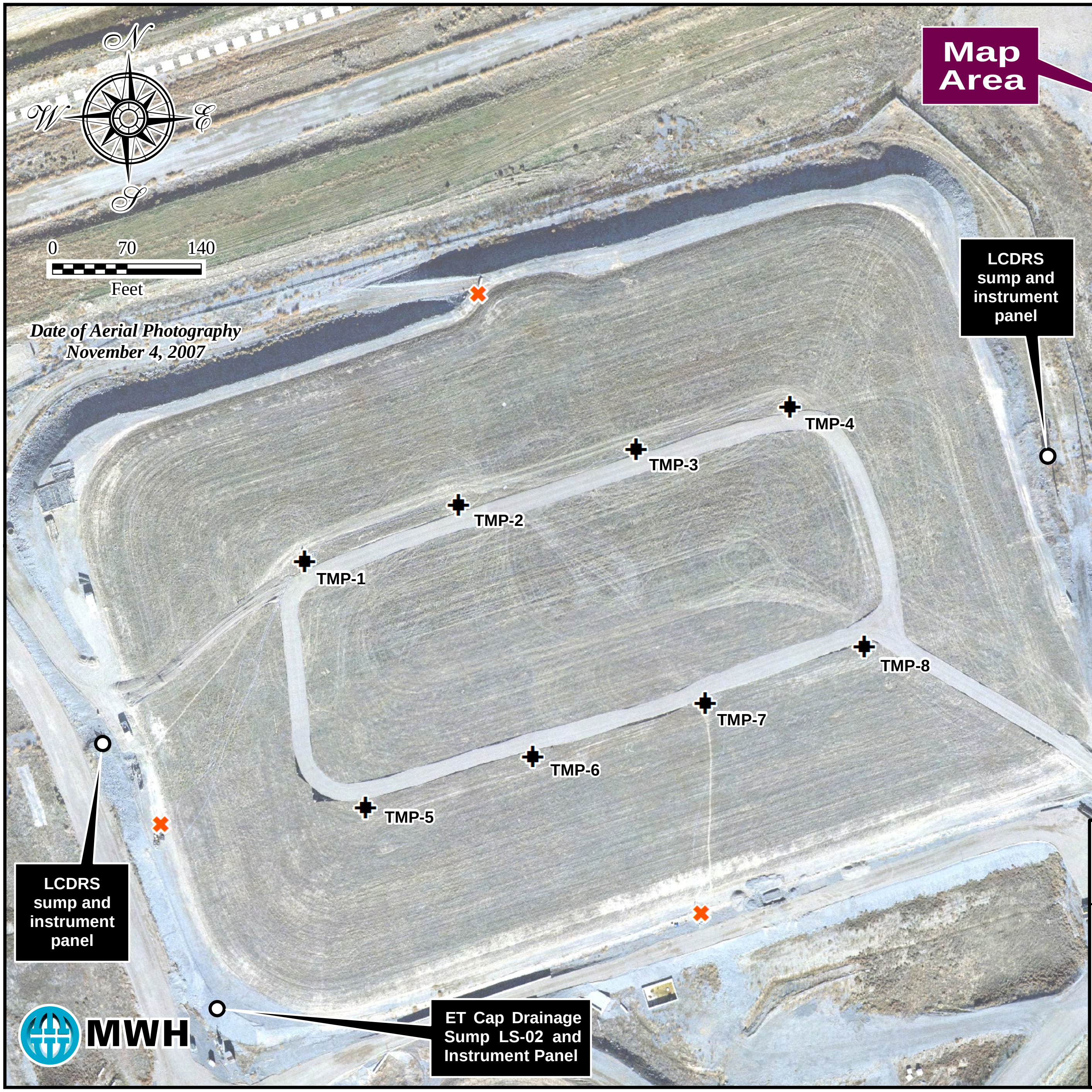
GETS PROCESS FLOW DIAGRAM

SCALE	WARNING					
NTS	0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED * DRAWN JJC 10/07/08 CHECKED * REV: JJC 03/05/13	MWH	FMC FMC CORPORATION POCATELLO, IDAHO	A&E ENGINEERING INC. POCATELLO, ID	POND 16S CURRENT GETS CONFIGURATION	Figure 3–1



SCALE	WARNING		MWH	FMC CORPORATION POCATELLO, IDAHO	A&B ENGINEERING INC. POCATELLO, ID	POND 16S GETS PH3 CONCENTRATION AND TEMPERATURE MONITORING LOCATIONS	Figure 3-2
NTS	0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED * DRAWN JJC 10/07/08 CHECKED * REV: JJC 03/05/13					

FILE: I:\projects\FMCidaho\FMC_Interim_Workplan\FIGURES\Fig 4-1_FMC_Pond16S_Appurt Mon Locs_Mar2013.mxd



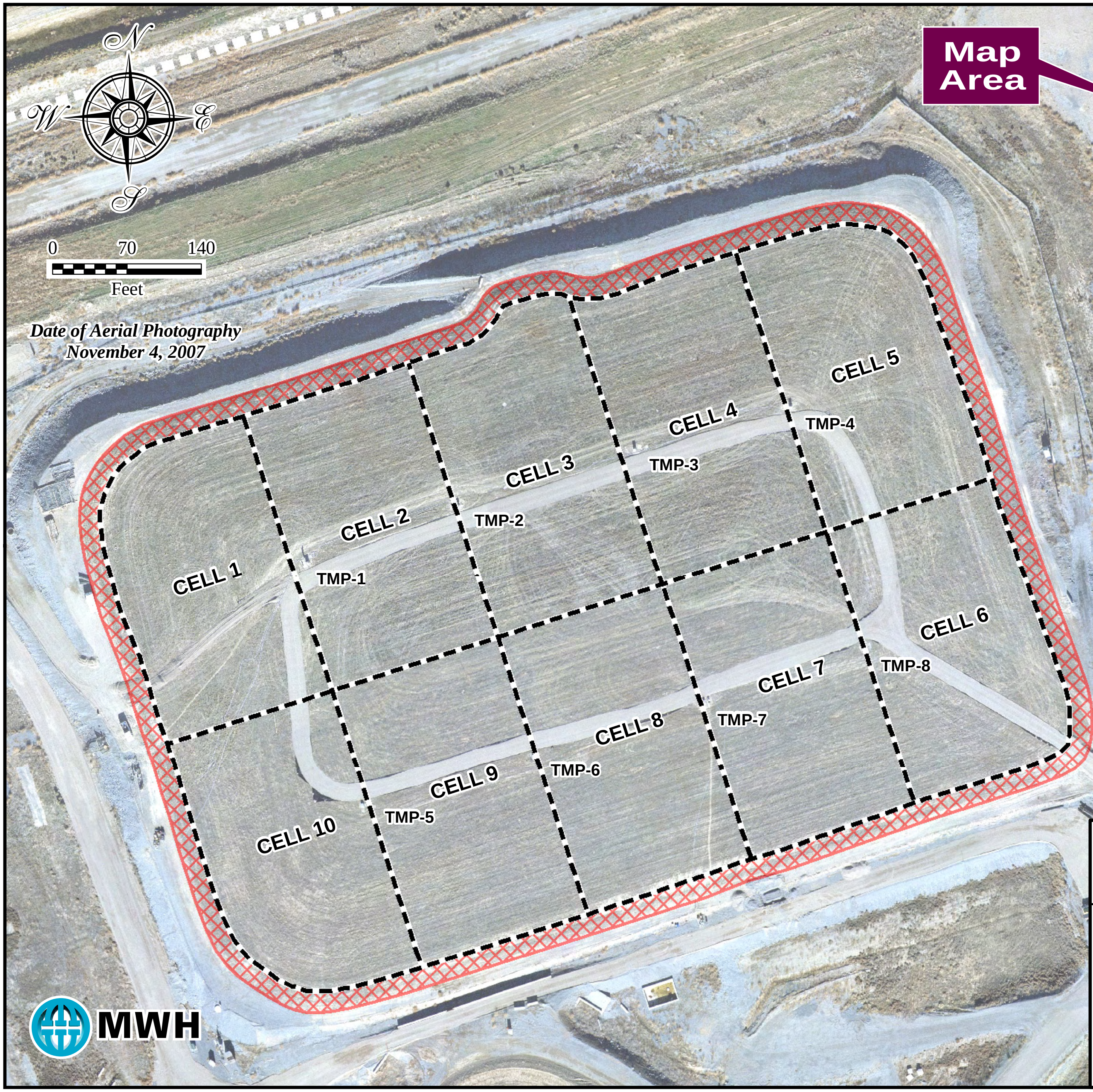
FMC

POND 16S
READILY IMPLEMENTABLE WORK PLAN

FIGURE 4-1

POND 16S APPURTENANCE MONITORING LOCATIONS

FILE: I:\projects\FMCidaho\FMC_Interim_Workplan\FIGURES\POND16S\Fig 4-2_FMC_Pond16S_SurfScanSampLocs_Mar2013.mxd



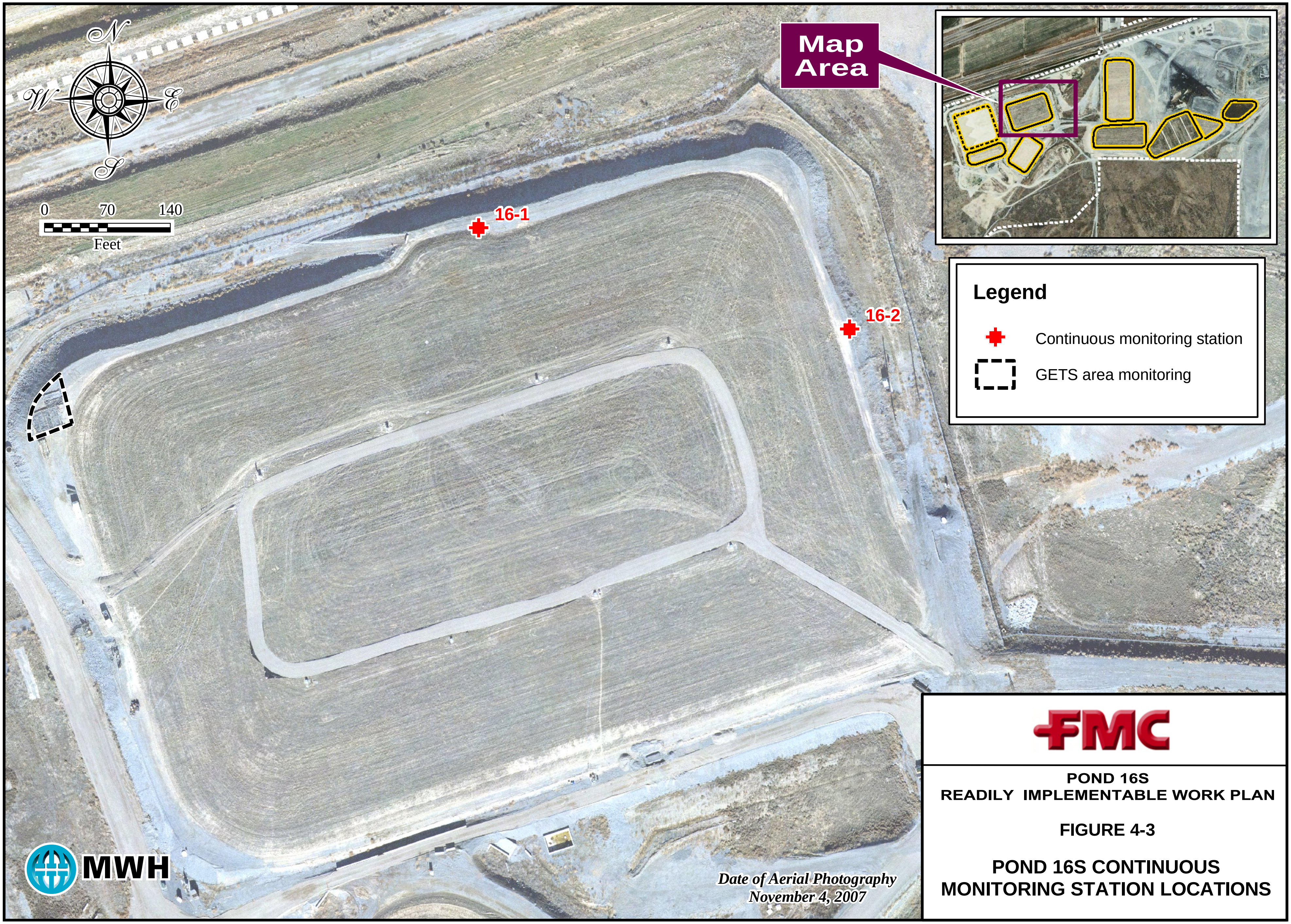
FMC

POND 16S
READILY IMPLEMENTABLE WORK PLAN

FIGURE 4-2

POND 16S SURFACE SCAN
MONITORING LOCATIONS

FILE: I:\projects\FMCidaho\FMC_Interim_Workplan\FIGURES\POND16S\Fig 4-3_FMC_Pond16S_Continuous Monitoring Locs_Mar2013.mxd



FMC

POND 16S
READILY IMPLEMENTABLE WORK PLAN

FIGURE 4-3

POND 16S CONTINUOUS MONITORING STATION LOCATIONS

Pond 16S Readily Implementable Work Plan

Appendix A

TMP Mechanical Drilling Procedure

TMP MECHANICAL DRILLING PROCEDURE

1. Complete Job Planning Safety Analysis (JPSA) for drilling of specific TMP:

   a. Identify potential job hazards.
   b. Prescribe appropriate monitoring during the procedure, i.e., PH3 monitoring.
   c. Prescribe appropriate PPE for employees performing procedure.

2. Prepare TMP for drilling:

   a. Remove TMP enclosure to provide access to TMP piping.
   b. Connect the mobile GES unit (with high-range flow meter) to the extraction connection on the TMP casing.
   c. Utilizing the sample port connection on the GES extraction piping, begin nitrogen purging into the TMP casing. Purge down the TMP until at least four conduit volumes have been purged through the TMP.
   d. Stop nitrogen purge and begin sweep gas flow using the mobile GES.
   e. Remove TMP thermocouple from TMP well. Note the length of the stainless-steel sheath removed from the casing.
   f. Continue sweep gas flow using the mobile GES.

3. Construct drill assembly:

   a. Build a drill assembly of the required length based on the length of the thermocouple sheath removed from the TMP well.
   b. The final section of the drill assembly must be the 12-inch drill adaptor rod designed to attach to the rotor-hammer drill.

4. Drill hole in bottom of TMP casing

   a. Insert drill assembly into ¾-inch thermocouple conduit.
   b. Accurately note the depth when the drill bit contacts the bottom of the casing.
   c. Attach rotor-hammer drill to drill bit adaptor assembly.
   d. Slowly begin drilling (whenever any binding is observed the drill will be reversed to relieve the binding).
   g. Track the drilling progress (It is expected that 2 to 3 inches of drilling will be required to completely break-through the drive cap bottom of the TMP casing).
   h. Stop drilling when break-through occurs. The design of the drilling coupling will prevent penetration beyond 10 inches below the drive cap.

5. Remove drill assembly from TMP well casing and observe the drill bit to determine bottom of drive cap condition (i.e. dry or wet).

6. Determine the TMP “max” flow capability:

    a. Install blind flange on the top flange of the TMP casing.
    b. Determine “max” flow capability utilizing the mobile GES.
    c. If desired extraction flow is possible then re-install TMP thermocouple (Step 7).
    d. If desired flow is not possible then it may be necessary to repeat Steps 2 thru 6.

7. Re-install TMP thermocouple:

    a. Shut off gas extraction through the mobile GES.
    b. Utilizing the sample port connection on the GES extraction piping, begin nitrogen purging into the TMP casing. Purge down the TMP until at least four conduit volumes have been purged through the TMP.
    c. Loosen bolts on blind flange on the top of the TMP.
    d. Re-establish the sweep gas flow utilizing the mobile GES.
    e. Remove the blind flange on the top flange of the TMP casing and re-install the TMP thermocouple with flange.
    f. Replace and secure the TMP enclosure.

FMC

FMC Idaho LLC, Pocatello, Idaho

POND 15S
READILY IMPLEMENTABLE WORK PLAN
FOR GAS EXTRACTION AND TREATMENT

June 10, 2014

MWH

TABLE OF CONTENTS

APPENDIX

TABLE

Table is placed behind Section 4.

FIGURES

Note that Figures are placed behind Section 5.

SECTION 1 INTRODUCTION

1.1 REQUIRED GAS EXTRACTION AND TREATMENT AT RCRA POND 15S

In a letter from EPA dated May 23, 2014 regarding Modification to Require Work Plans for Gas Extraction and Treatment and Additional Monitoring at RCRA Ponds 15S and 16S; CERCLA Unilateral Administrative Order for Removal Action, Docket No. CERCLA 10-2010-0170 ("UAO," effective July 12, 2010), EPA required FMC to prepare "Readily Implementable Work Plans" for gas extraction and treatment at Ponds l5S and l6S for submittal to EPA by June 10, 2014 such that they can be implemented within 48 hours upon approval. The Readily Implementable Work Plans must also include an air (surface scan and appurtenance) and perimeter pipe monitoring schedule and frequency that provides for more frequent monitoring when concentrations are rising or elevated above levels requiring the initiation of gas extraction and treatment, and for less frequent monitoring based upon falling concentrations.

1.2 SCOPE OF THIS WORK PLAN

The scope of this plan is to provide the Readily Implementable Work Plan for gas extraction and treatment at Pond 15S as directed by the May 23rd EPA letter. As gas extraction and treatment has previously been performed at Ponds 16S and 15S, separate Readily Implementable Work Plans have been prepared and submitted for each of these RCRA ponds which are consistent with earlier approved work plans.

This *Pond 15S Readily Implementable Work Plan for Gas Extraction and Treatment* is based largely on the previously EPA-approved gas extraction and treatment system (GES) unit design and operating procedures specified in the Pond 18A Interim Work Plan for Gas Extraction and Treatment (March 8, 2013).

1.3 PROJECT ORGANIZATION

The key personnel associated with the performance of the project described in this Work Plan and associated responsibilities presented in the following subsections.

1.3.1 EPA On-Scene Coordinator

The EPA On-Scene Coordinator, as specified in the UAO, is Mr. Greg Weigel, of the Emergency Response Unit, Office of Environmental Cleanup, Region 10.

1.3.2 FMC Remediation Director

The FMC Remediation Director, Ms. Barbara Ritchie, is responsible for overall program implementation, quality and reporting. The Remediation Director is responsible for setting up and procuring the services and ensuring that FMC receives the quality and scope of work described in the contract documents. The Remediation Director is the only person with the authority to change the scope of the project, which is done through the process of change orders and contract modifications.

1.3.3 MWH Project Coordinator

The Project Coordinator will perform overall engineering oversight of the project. The Project Coordinator will interact and communicate directly with the FMC Remediation Director on a regular basis to ensure that the requirements of the contract documents are met and that regulatory issues relating to the UAO are addressed. The MWH Project Coordinator will be Rob Hartman.

1.3.4 KW Health and Safety Manager

The Health and Safety Manager (HSM) has overall responsibility for implementation and maintenance of the site Health and Safety Plan. The HSM is responsible for monitoring and assessing hazardous/unsafe situations, developing measures to assure personnel safety, maintaining the emergency response organization and equipment per the RCRA Contingency Plan, performing job planning safety analyses (JPSA) on job tasks, and training of employees commensurate with their responsibilities. The HSM is also responsible to ensure unsafe acts or conditions are corrected in a timely manner. The Health and Safety Manager is Mark Smith.

SECTION 2 SUMMARY OF PRIOR UAO ACTIONS AT POND 15S

The RCRA Pond UAO Removal Action Completion Report submitted on June 25, 2013 describes prior gas extraction at Pond 15S in the period 2010 to 2013. Monitoring has been conducted since that time at Pond 15S. The perimeter pipe, appurtenances and perimeter surface scan monitoring results have been reported to EPA in monthly reports pursuant to the UAO.

SECTION 3 GAS EXTRACTION AND TREATMENT DESIGN AND OPERATION

3.1 APPROACH FOR GAS EXTRACTION AND TREATMENT

The purpose of this section is to describe the design and operation of the individual GES unit(s) and the overall approach for gas extraction and treatment at Pond 15S.

Section 3.2 provides a description of the design and operation of a single GES unit. Section 3.3 provides the overall approach for deployment / operation of the GES unit at Pond 15S for the gas extraction and treatment.

3.2 GES UNIT DESIGN AND OPERATION

The GES unit design and operation is described below. Sections 3.2.1 through 3.2.4 were taken from the 18A Interim Work Plan (for) Gas Extraction and Treatment (March 8, 2013) and modified as appropriate for Pond 15S.

3.2.1 Summary of GES Operational Requirements

The GES operator will need to understand the catalytic carbon adsorption system, operate the system correctly, monitor system performance, maintain appropriate records, ensure ongoing preventative maintenance is completed, and replace system components as necessary.

The PH3 gas extraction system extracts pond soil gas from the perimeter gas collection piping by means of a vacuum pump. Gas from the perimeter gas collection piping is blended with fresh air to achieve an inlet gas contraction of about 300 ppm PH3. Draeger Pac III PH3 (or Pac 7000 / X-AM 5000) monitors calibrated to 0-20 ppm and 0-1000 ppm are used for PH3 concentrations. The gas then passes through two carbon filter drums connected in series and is discharged to the atmosphere. Five temperature gauges, four pressure gauges, three flowmeters, and portable PH3 gas monitors are used to indicate operating conditions. An automatic vacuum relief valve, two solenoid valves, a nitrogen fire suppression system, an internal alarm system, and an automatic system control interlock provide safeguards for the system.

Normal Operating Conditions

- The normal blended gas inlet feed rate is 50-80 cfm.
- The normal operating PH3 concentration entering the first drum will be about 300 ppm.
- Maximum operating PH3 concentration entering the first drum will be 1,000 ppm.

- Maximum outlet temperature from the first drum downstream of the vacuum pump shall be 225° F.
- When the PH_3 concentration exiting the first drum reaches 10-15 ppm, the first drum will be replaced (normally by rotating the second carbon drum into the first drum position and replacing the second position with a new drum).
- If the pressure differential across either the first or second drum exceeds 20 inches of water, an inspection of the drum shall be made followed by appropriate action to reduce the pressure differential below 20 inches of water.
- The discharge PH_3 concentration shall be less than 0.3 ppm during normal operation.

Tools and Equipment

- High range portable PH_3 gas monitor. Draeger Pac III (or Draeger X-AM 5000) portable monitor calibrated for 0 to 1000 ppm range.
- Low range portable PH_3 gas monitors. Draeger Pac III (or Draeger PAC 7000) portable monitor calibrated for 0 to 20 ppm range for monitoring low concentrations of PH_3.
- Pipe wrenches, fittings to connect/disconnect piping and instrumentation.
- Parts and tools to perform maintenance on the vacuum pump, piping and instrumentation.
- Barrel mover to move drums

Safety Equipment

- Safety glasses, gloves, and other required PPE
- Cell phone
- Industrial hygiene (IH) personal PH_3 monitor. (ToxiPro A5.7 PH_3 meter with a range of 0-20 ppm PH_3 and alarms set at 0.3 ppm and 1.0 ppm or equivalent monitor.)
- Fire extinguisher

3.2.2 GES Unit System Design And Description

System Operating Criteria

The goal for operation of the carbon adsorption system is to reduce the PH_3 gas concentration to less than 0.3 ppm at the exhaust.

The system equipment described below and the operating procedures provided in later sections of this document are designed to achieve these criteria.

System Equipment and Arrangement

The perimeter gas collection piping was installed at Pond 15S under the final cap liner. The perimeter gas collection piping system was constructed with a 2" perforated PVC pipe inside the perimeter anchor trench. Two collection locations (standpipes) are currently available, one on the east side and one on the southwest side of the pond cap. Both of these locations are available for perimeter piping gas extraction.

The system operating equipment list is:

- Power supply either from utility provider or portable diesel generators.
- An explosion-proof vacuum pump. GAST model R6P355R-50, 3-phase, 480 volt, 60 Hz, 6 hp, maximum capacity 80 cfm, 85" water vacuum, and 100" water pressure. The pump is equipped with automatic vacuum relief valve AG-258, inlet filter AJ151G, motor starter and controller.
- A condensate liquid separator drum.
- Gas inlet flow meters – High range Fox Valve Development Corp. model 617609 venturi flow meter (range 0 to 10 cfm), Low range Fox Valve Development Corp. model 618453 venturi flow meter (range 0 to 2 cfm),
- Total air flow meter – Omega high accuracy pitot tube FPT-6000 series.
- Temperature gauges (3), 0 to 250 F, 4" face, Omega J-0-250F-4-1/2 or equivalent.
- Temperature thermocouples (2), 4", Type K, Omega NB12-CASS-18U-4 or equivalent.
- Temperature indicating controllers (2) with 2 alarm setpoints, Moore 330RD
- Vacuum gauges (2) -60 to 0 " water, McDaniel J60-0, 2½, ¼LM or equivalent
- Pressure gauges (2) 0 to 100 " water, McDaniel J0-100, 2½, ¼LM or equivalent
- Two carbon adsorption drums installed in series. Calgon Centaur™ 4 X 6 activated carbon system in 55-gallon Ventsorb canisters.
- Flow indicators - Wika 732.51 Differential Pressure Gage (316SS wetted; 4" gage; range as needed in inches H2O) or Equivalent
- A nitrogen purging system.

Fresh Air Blending

Fresh air is required to maintain the inlet gas concentration at about 300 ppm PH3. The blending valve is located near the condensate drum inlet. The blending air valve HV-5 and the source valves HV-1 and HV-2 are adjusted as necessary to blend source gas and fresh air, which serves to dilute the PH3 concentration of the source gas and to control the operating temperature of the GES unit. The PH3 concentration is monitored at the inlet and outlet of the No. 1 carbon drum, as well as at the discharge to atmosphere from the No. 2 drum. The discharge concentration from the No. 2 drum will be maintained at less than 0.3 ppm.

The gas temperature is another indicator of system operation. Temperature gauges are provided at the inlet and outlet of the vacuum pump, and thermocouples are provided at the outlet of the first drum and the outlet of the second drum. The adsorption of PH3 onto the activated carbon is an exothermic (heat-producing) reaction. High inlet concentration of PH3 gas can result in sub-standard adsorption in the first carbon drum, causing a rise in the exit temperature. When the exit temperature from the first drum (TI-4) reaches 225°F, the high temperature interlock will close solenoid valve SV-1 shutting down the source gas extraction from the perimeter gas collection pipe and put the system on an air purge. An alarm will also indicate operator attention is required. If the exit temperature from the first drum (TI-4) or the second drum (TI-5) reaches 250°F, the high-high temperature interlock will close solenoid valve SV-1 and the vacuum pump will automatically shut-down thus stopping gas extraction. The solenoid valve SV-2 (nitrogen purge valve) will open automatically and flush the system for approximately 10 minutes with nitrogen to suppress any reaction and purge PH3 from the system (see Figure 3-1).

Drum Replacement

Monitoring of PH3 concentrations at the inlet and outlet of the first Calgon Ventsorb drum provides an indication of PH3 adsorption performance. When the outlet PH3 concentration of the first drum reaches 10-15 ppm, the drum will be replaced. The standard operating procedure will be to move the second drum to the first position and install a new drum of carbon in the second position.

Pressure gauges are provided at the inlet and outlet of the first drum to measure the pressure drop. Inlet and outlet pressure differential is an indicator of drum performance. When the pressure drop through either the first drum or the second drum is 20 inches of water or greater, an inspection of the drum is required. That inspection may indicate problems requiring drum maintenance (i.e. plugged baffle or piping) or require replacement of the carbon.

Drum Temperature Interlocks

The gas temperature is another indicator of system operation. Temperature gauges are located at the pond gas flow meter, at the inlet and outlet of the vacuum pump, and thermocouples are provided at the outlet of the first drum and the outlet of the second drum. The adsorption of PH3 onto the activated carbon is an exothermic (heat-producing) reaction. High inlet concentration of PH3 gas can result in sub-standard adsorption in the first carbon drum, causing a rise in the exit temperature. When the exit temperature from the first drum (TI-4) reaches 225°F, the high temperature interlock will close solenoid valve SV-1 shutting down the source gas extraction from the perimeter gas collection pipe and put the system on fresh air purge. An alarm will also indicate operator attention is required.

If the exit temperature from the first drum (TI-4) or the second drum (TI-5) reaches 250°F, the high-high temperature interlock will close the source gas solenoid valve SV-1 and the vacuum pump will automatically shut-down thus stopping gas extraction from the standpipe (or extraction manifold). The solenoid valve SV-2 (nitrogen purge valve) will open automatically and flush the system for approximately 10 minutes with nitrogen to suppress any reaction and purge PH3 from the system (see Figure 3-1).

3.2.3 GES Unit Operation

The PH3 gas extraction and treatment system extracts pond gas from perimeter collection pipe by means of a vacuum pump. The gas then passes through two carbon adsorption drums connected in series and discharges to the atmosphere. Fresh air is blended into the system to control the temperature and PH3 concentration. Temperature gauges, pressure gauges, flow meters, and PH3 gas monitors are provided to indicate operating conditions. An automatic vacuum relief valve, thermocouples, alarm systems, and solenoid valves, program logic and a nitrogen suppression system provide safeguards for the system.

Based on the previous successful deployment of multiple GES units at the east and west standpipes at Pond 15S, a similar approach of GES unit deployment at Pond 15S is expected to be sufficient for future gas extraction and treatment at Pond 15S.

The system operation is described below.

The Gas Path

Gas under the Pond 15S cap will be extracted from a gas collection standpipe by suction using fresh air as blending gas. The blended gas stream then passes through a condensate drum to protect the vacuum pump. The vacuum pump exhausts into two carbon adsorption drums operating in series and the treated gas is then discharged to the atmosphere.

Fresh Air Blending

Fresh air is blended with source gas to the gas path to maintain a nominal inlet PH3 concentration of about 300 ppm. The main control valve for blending in fresh air HV-5 is located upstream of the condensate drum a flow meter indicates the amount of source gas that is being introduced.

Temperature Controls

Temperature gauges are located at the pond gas flow meter, at the inlet and outlet of the vacuum pump to indicate temperature. Thermocouples are located at the exit of the first carbon drum and the exit of the second carbon drum. The maximum temperature at the exit of the first carbon drum for normal operation is 225°F.

Pressure Controls

Pressure gauges are located to monitor the pressure differential across the first carbon drum and second carbon drum. The pressure differential across the carbon drums should be less than 20” water for normal operation. Pressure differential readings above 20” water indicate a need to inspect the drum(s) and associated piping.

Phosphine Controls

Phosphine concentrations at the inlet to the first drum, the outlet of the first drum, and the outlet of the second drum are monitored and recorded periodically as well as during start up or prior to shut down. Phosphine monitor connections are located at the inlet and outlet of the first carbon drum and at the outlet of the second drum.

The inlet PH3 concentration at the first drum should be kept at about 300 ppm PH3 for optimum system operation. Hand-held PH3 monitors (Draeger Pac III [or X-AM 5000 / Pac 7000]) calibrated for 0 to 1000 ppm or 0 to 20 ppm PH3 are used for this monitoring. When the outlet concentrations from the first drum reaches 10-15 ppm, the first drum is replaced.

The discharge concentration of PH3 from the second drum should be less than 0.3 ppm PH3 at all times. A hand-held PH3 monitor (Draeger Pac III or Pac 7000) calibrated for 0 to 20 ppm is used for this monitoring. A discharge concentration of 0.2 ppm or more would indicate that the operator needs to adjust (i.e., increase) the amount of fresh air being blended with the perimeter pipe source gas or decrease the flow of the perimeter pipe source gas.

Draeger Pac III [or X-AM 5000 / Pac 7000] portable monitor calibrated for 0 to 1000 ppm or 0 to 20 ppm PH3 is calibrated once every two weeks using factory recommended procedures and calibration gas. Phosphine levels at the blended inlet to the first drum, the outlet of the first drum and the outlet of second drum are monitored at every start-up, prior to shut down and periodic daily operation levels and recorded. Using the combined flow rate, the perimeter pipe extraction rate and the combined concentration, the perimeter pipe PH3 concentration can be estimated.

System Safeguards

1. An automatic vacuum relief valve is located at the inlet to the vacuum pump to prevent excessive vacuum pressure.
2. A control interlock between the thermocouple TI-4 and the solenoid valve SV-1 control the source gas. When the outlet temperature of the first drum at TI-1 reaches 225°F, indicating undesirable adsorption condition, the solenoid valve SV-1 will automatically close to prevent additional pond gas from entering the system leaving the system on air purge. An alarm will also indicate that operator attention is required.
3. An automatic nitrogen purge system with a manual bypass is tied into the discharge from the vacuum pump. The nitrogen system will turn on automatically when the temperature of the first drum or the second drum outlet exceeds 250°F and the vacuum pump will also shut down. This will minimize the potential for any fires or high heat damage in the carbon drums. During an automatic nitrogen system purge, the source gas solenoid valve (SV-1) will automatically close to prevent additional pond gas from entering the system.

3.2.4 Operating Procedures

Start-up Procedure

This procedure is to be followed when starting the system after a normal shut down or when introducing additional units. In the event of an auto shut down or power outage, follow the procedure described in the START UP PROCEDURE AFTER AN AUTO SHUT DOWN OR POWER OUTAGE section of this document.

Follow Health and Safety Plan and RCRA Pond Area Work Rules

1. Identify the standpipe (or collection header port) being used for gas extraction. Verify that all components of the extraction piping upstream of the GES unit are in place and that all components are properly connected as shown on Figure 3-1.
2. Attach the flex hose to the standpipe (or collection header port) and verify that all inlet valves are closed (HV-1, HV-2, HV-3, HV-4, and sample port SPV-3).
3. Use the appropriate portable PH3 monitor to check the system area for PH3. Continue with start up if conditions are satisfactory.

4. Check nitrogen level in the cylinder for the nitrogen fire suppression system. If below ~800 psi, replace the nitrogen cylinder (a full bottle should allow for approximately 3 air exchanges in the system, if needed). Ensure that the nitrogen bottle outlet pressure regulator is set at 30 psi minimum.
5. Check that all hoses, hose connections, filters, piping, and drums are in good working condition. Notify supervisor of any equipment problems **before** proceeding with start up.
6. There are a total of 11 hand valves in the system as shown in Figure 3-1. The operator should ensure the following valves are **CLOSED** to prepare the system for start up:

	Source valve at collection header
SV-1	System inlet solenoid valve (fail close)
HV-1&2	Pond gas throttling valve
HV-3&4	Pond gas block valve
HV-7	Nitrogen purge solenoid bypass valve
SV-2	Nitrogen purge solenoid supply valve (fail close)
SPV-3	Pond gas sample port valve
SPV-1	No. 1 carbon drum inlet sample port valve (PH3-1 on log sheet);
SPV-2	No. 1 carbon drum outlet sample port valve (PH3-2 on log sheet);
HV-8	Condensate drum drain valve.

NOTE: Solenoid valves (SV-1 and SV-2) fail closed with loss of electricity.

7. The operator should ensure that the following valves are **OPEN** to prepare the system for start up:

Nitrogen purge supply block valve at the N2 bottle (normally open)

HV-5 Fresh air blending valve (normally open)

HV-6 Vacuum pump discharge block valve (normally open).

8. Make sure the main circuit breaker at system is on.

NOTE: Once the power is on, it will allow the solenoid valve on the inlet to the condensate drum (SV-1) to operate.

9. Turn on power to the motor starter for the vacuum pump. The system should begin to operate.

   After ensuring proper air flow, allow the system to run for an appropriate period of time to bring the carbon drums up to a steady-state temperature. For initial start-up, this is typically about 2 hours. Connect the appropriate portable PH3 monitor at the sample port at the inlet to No. 1 carbon drum, open valve SPV-1, and monitor to verify that the system is purged of any residual PH3. Verify that the system is functioning properly.

10. Open the source valve at the collection header, open the pond gas block valve HV-3 or HV-4 (depending on high or low flow) and verify that the solenoid valve (SV-1) at the system inlet is open.

11. Slowly open the pond gas throttling valve (HV-1 or HV-2) until the PH3 concentration at No. 1 drum sample port reaches 300 ppm or the No. 2 drum outlet reaches 0.20 ppm max, whichever is first.

    CAUTION: DO NOT EXCEED 1,000 ppm to avoid overheating and damage to the carbon adsorption drums.

12. Adjust and monitor operating conditions – PH3 concentration will normally be targeted at about 300 ppm at the inlet to the No. 1 carbon drum. Adjust the throttling valve (HV-1 or 2) as necessary to regulate temperature and pond gas concentration.

13. Record start up conditions as outlined in the Daily Recording Procedure.

Procedure for Start-up After an Auto Shut Down or Power Outage

Follow Health and Safety Plan and RCRA Pond Area Work Rules

1. Prior to working in extraction system area or collection header areas, use the appropriate portable PH3 monitor to check work areas for PH3.
2. Close the source gas valve at collection header and pond gas throttling valve (HV-1 or 2).
3. Observe all PH3 sample point (PH3-1, PH3-2 and PH3-3) readings.
4. If high PH3 is detected, continue to purge the system using the Nitrogen Suppression Procedure Steps 6 thru 8.
5. Prepare the system for start up as outlined in Steps 6 thru 10 of the standard Start-up Procedure.

6. Observe and monitor the system for 15 minutes for high PH3 at sample ports, elevated temperatures or scorching evidenced by discolored paint, visible smoke, or unusual odors. Return to Step 5 if any of these situations are observed.
7. Allow the system to run on fresh air for an additional 30 minutes or until normal condition is resumed.
8. Continue the standard Start-up Procedure Step 11.

Recording (required daily at standard interval, at start up and prior to shut down.)

1. At start-up, follow the standard Start-up Procedure.
   Record the date, time, operator initials and ambient temperature (T1) on the System Monitoring Log.
2. Connect the appropriate portable PH3 monitor at the inlet of No. 1 carbon drum and slightly open the sample valve (SPV-1) to establish slight flow past the PH3 monitor, record the reading (PH3-1), close the valve, and remove the PH3 monitor.
3. Repeat Step 3 for No. 1 carbon drum outlet (SPV-2) and record the reading (PH3-2).

   CAUTION: Connect the discharge of the sampling monitor to blending air inlet via hose and away from personnel to avoid potential exposure to a low flow of PH3.

4. Repeat Step 3 for No. 2 carbon drum outlet and record the reading (PH3-3).
5. Review and readjust pond gas perimeter pipe throttling valve setting as necessary to maintain normal operating conditions. See the standard START-UP PROCEDURE.
6. Fill out the rest of the System Monitoring Log and check the No. 1 carbon drum condition. Pressure differential between inlet and outlet should be less than 20” of water.
7. If conditions are not within these parameters, shut down the system using Shut Down Procedure and change the No. 1 carbon drum per Drum Changing Procedure.

Shut Down

1. Record the final readings as outlined in the System Monitoring Log.
2. Close the source gas valve at collection header.
3. Allow the inlet hose and the system to run for 30 minutes on fresh air to purge out residual PH3.
4. Connect the appropriate PH3 monitor at the sample port at the inlet to No. 1 carbon drum (SPV-1) and monitor to verify that the system is purged of any residual PH3.

5. Turn off the power to the motor starter for the vacuum pump.
6. Close dilution air valve HV-5.

Drum Changing

1. Shut down the system following the Shut Down Procedure.
2. Unscrew the unions connecting both drums.
3. Remove the first drum and secure it with caps.
4. Relocate the second drum to the first drum position.
   Install a new drum or install a refilled drum to the second drum location.
5. Label each drum with the date of installation and date of removal and record in logbook as appropriate.
6. Re-connect the two active drums.
7. Re-start the system according to Start-up Procedure.
8. Empty the carbon from the drum to an accumulation bin for proper disposal.
9. Save the empty drum to be refilled with fresh activated carbon

Nitrogen Suppression

SAFETY NOTE - When the exit temperature from either drum reaches 250°F, the solenoid valve SV-1 will close and cut off gas intake from the pond gas and the blower will also shut down. The solenoid valve SV-2 (nitrogen purge valve) will open AUTOMATICALLY and flush the system for 5 minutes with nitrogen to suppress any burning reaction (see Figure 3-1).

The following manual procedure is to be used when drum conditions indicate overheating.

1. Shut down the system by turning off power to the motor starter and circuit breaker.
2. Close the source gas valve at collection header and pond gas throttling valve (HV-1 or 2).
3. Close the vacuum pump discharge block valve (HV-6).
4. Verify there is nitrogen available in bottle and the regulator is set at 30 psi.
5. Open the nitrogen solenoid bypass valve (HV-7) to purge the system from No. 1 carbon drum through to the discharge of No. 2 carbon drum.

6. Observe PH3 readings at sample ports (PH3-1, PH3-2, and PH3-3) and temperature (TI-4 and TI-5) and pressure (PI-2 and PI-3) readings.
7. Close nitrogen solenoid bypass valve (HV-7).
8. Open the vacuum pump discharge block valve (HV-6).
9. Re-start the system following the instructions outlined in the Start Up Procedure After an Auto Shut Down or Power Outage Steps 5 thru 9.

3.3 POND 15S EXTRACTION AND TREATMENT SYSTEM OPERATION

Operation of the GES units at Pond 15S will be consistent with prior successful extraction and treatment at Pond 15S. Specifically,

- Continue implementation of gas extraction at Pond 15S on a 12-hour per day, seven days a week (12/7) schedule using four GES units extracting at the southwest standpipe and one GES unit extracting from the east standpipe at Pond 15S. This extraction scheme represents an average PH3 mass removal rate of 6 pounds per day (lb/day), approximately 150% of the net PH3 generation rate estimated for Pond 15S in 2012.
- Implement (or continue to implement) the PH3 monitoring at Pond 15S as described in Sections 4.1 and 4.2.

The operation of the GES unit may be modified over time, based on monthly review of the monitoring data, to increase or decrease the monthly-averaged daily PH3 mass removal rate. Following an initial period of GES unit operation to establish an extraction rate that yields a steady state source gas concentration, estimated to take 30-60 days based on initial extraction at Pond 15S and other ponds, adjustments will be made to maintain the perimeter pipe concentrations below 10,000 ppm. In addition, decreasing the monthly-averaged daily PH3 mass removal rate may be necessary to maintain efficient GETS operation, e.g., maintain 300 ppm inlet PH3 concentrations. The rate of PH3 removal from the perimeter pipe will be increased by: (1) adding additional GES units extracting from the perimeter pipe outlet(s) and/or (2) increasing the operating time of the current GES unit(s) if not currently operating 24/7. The rate of PH3 removal from the perimeter pipe may be decreased by: (1) reducing the number of GES units extracting from the perimeter pipe outlet(s), (2) discontinuing extraction at additional perimeter pipe outlets (if available and extraction was in progress), or (3) reducing the operating time of the current GES units. FMC will notify EPA and obtain EPA approval prior to increasing or decreasing the number of GES units deployed at Pond 15S.

As has been experienced at TMPs, the TMPs can become flow restricted as a result of a quantity of sand pack material (used during TMP installation) plugging the bottom of the TMP. If necessary to facilitate gas extraction from a TMP(s) using a GES unit(s), a TMP cleaning/drilling procedure has been developed to allow for the safe removal of the sand pack material and drilling through the bottom of the TMP casing in order to establish or re-establish flow at the plugged TMP. The TMP Mechanical Drilling Procedure (Updated May 24, 2012) is included as Appendix A.

Should the monthly GES unit source gas PH3 concentration at both standpipes decrease below 2,000 ppm as measured using the dilution box method specified in Section 4.2.2, FMC will notify EPA and cease gas extraction and treatment at Pond 15S. Monitoring will continue pursuant to the then-applicable EPA-approved plan (e.g., this Readily Implementable Work Plan or an amended RCRA Pond Post-Closure Plan).

3.4 WASTE MANAGEMENT

Based upon experience with GES unit extraction from perimeter pipe standpipes, generation of the following solid wastes are anticipated for the Pond 15S GES unit operation:

- Spent carbon;
- Condensate; and
- Maintenance debris.

These anticipated solid waste streams are discussed below.

Spent Carbon

Approximately 300 pounds of spent activated carbon are anticipated to be generated each time a carbon drum is replaced. The point of generation of this waste stream will be upon removal of the spent carbon from the carbon drum. Based upon testing, process knowledge, and experience with the existing gas extraction and treatment systems, the spent carbon is not anticipated to be a hazardous waste per 40 CFR Part 261. However, a periodic waste determination will be performed and documented per 40 CFR § 262.11.

Condensate

Condensate may be generated during operation of the treatment system. The point of generation of this waste stream will be upon removal of the condensate from the GES system piping. Based upon testing, process knowledge, and experience with the existing gas extraction and treatment systems, the condensate is not anticipated to be a hazardous waste per 40 CFR Part 261. However, a periodic waste determination will be performed and documented per 40 CFR § 262.11.

Maintenance Debris

Varying amounts of maintenance debris is anticipated to be generated from the operation of the GES unit. The point of generation of these waste streams will be upon the point of disposal. Although these wastes are not anticipated to be hazardous per 40 CFR Part 261, a waste determination will be performed and documented per 40 CFR § 262.11 with the initial generation of each waste category, i.e., packaging materials, replaced equipment, monitoring wastes, spent PPE, etc.

Wastes that have been determined to be non-hazardous per 40 CFR § 262.11 will be either disposed on site or transported offsite for recycle or disposal. Wastes that are determined to be hazardous per 40 CFR § 262.11 will be managed in accordance with the regulatory requirements of 40 CFR Part 262, 265, and 268 including but not limited to:

- Land disposal restrictions per 40 CFR Part 268;
- EPA identification number per 40 CFR Part 262.12;
- On-site hazardous waste accumulation (storage) per 40 CFR § 262.34(d);
- If the waste is placed in containers, the requirements of 40 CFR Part 265 Subpart I;
- If the waste is placed in tanks, the requirements of 40 CFR 265 Subpart J (tank requirements):
- At closure, the storage area is closed per the requirements of 40 CFR § 265.111 and 40 CFR § 265.114;
- Preparedness and prevention requirements of 40 CFR Part 265 Subpart C;
- Contingency plan and emergency response requirements of 40 CFR Part 265 Subpart D;
- Training requirements of 40 CFR § 265.16;
- Satellite accumulation requirements of 40 CFR § 262.34(c);
- Manifesting off-site shipments of hazardous per 40 CFR § 262.20; and/or
- Reporting and recordkeeping per 40 CFR § 262.40.

SECTION 4 MONITORING AND REPORTING

4.1 MONITORING UNDER THE AIR MONITORING PLAN

Monitoring pursuant to the Air Monitoring Plan as applied to Pond 15S per this RIWP will be performed at Pond 15S during and after ceasing gas extraction and treatment. A summary and schedule for the PH3 monitoring at Pond 15S is shown on Table 4-1. The monitoring will be performed following the procedures detailed in the Air Monitoring Plan (January 2011).

- Air Monitoring per the Air Monitoring Plan – Part I
  - Pond appurtenance air monitoring and leak detection monitoring at the 10 TMP enclosures, 2 ET cap drainage collection lift stations, 4 LCDRS sump, 3 instrument panels and 2 standpipes at Pond 15S will initially be performed on a monthly basis upon commencement of and during gas extraction and treatment. Following ceasing gas extraction and treatment per the criteria in Section 3.3, appurtenance monitoring will revert to quarterly. If, based on quarterly perimeter pipe monitoring, the PH3 concentration in one or more standpipes is greater than 2,000 ppm, appurtenance monitoring will be performed monthly until the perimeter pipe PH3 concentrations return to below 2,000 ppm. When perimeter pipe PH3 concentrations are below 2,000 ppm, monitoring will be quarterly. After four (4) consecutive quarters of appurtenance monitoring, if there have been no detections of PH3 at or above 0.05 ppm of PH3 at any appurtenance, the frequency will be reduced to annually for Pond 15S unless the perimeter pipe PH3 concentration is above 2,000 ppm. The Pond 15S appurtenance monitoring locations are shown on Figure 4-1.
  - Pond perimeter surface scan monitoring will be performed at Pond 15S on a monthly basis, provided that required weather and/or ground surface conditions allow such monitoring during the month upon commencement of and during gas extraction and treatment. Following ceasing gas extraction and treatment per the criteria in Section 3.3, perimeter surface scan monitoring will revert to quarterly. If, based on quarterly perimeter pipe monitoring, the PH3 concentration in one or more standpipes is greater than 2,000 ppm, perimeter surface scan monitoring will be performed monthly until the perimeter pipe PH3 concentrations return to below 2,000 ppm. When perimeter pipe PH3 concentrations are below 2,000 ppm, monitoring will be quarterly. After four (4) consecutive quarters of cap perimeter surface monitoring, if there are no PH3 detections at or above 0.05 ppm of PH3 at the cap perimeter surface, this monitoring frequency will be reduced to

annually on Pond 15S unless the perimeter pipe PH3 concentration is above 2,000 ppm. The Pond 15S surface scan monitoring locations are shown on Figure 4-2.

- Pond cap surface scan – if triggered by pond perimeter surface scan.
- Low-lying areas – if triggered by monitoring listed in previous three sub-bullets.

- Air Monitoring per the Air Monitoring Plan – Part II
  - Continuous monitoring at four locations at Pond 15S (the same EPA approved locations during prior gas extraction and treatment at Pond 15S). Continuous monitoring will be performed during periods when the GES unit(s) is (are) extracting pond gas. The Pond 15S continuous monitoring station locations are shown on Figure 4-3.
  - Fenceline monitoring - if triggered by criteria set forth in the Air Monitoring Plan; and Off-site monitoring – if triggered by fenceline monitoring criteria set forth in the Air Monitoring Plan.

In addition to the above Air Monitoring Plan monitoring, inside appurtenance monitoring will be performed on the same frequency as the appurtenance air monitoring and leak detection monitoring. Note that there is no inside monitoring at perimeter pipe standpipes. The inside appurtenance monitoring will be performed following the procedures detailed in Section 3.4 of the Phosphine Assessment Work Plan – Final (July 2011).

4.2 GES Unit Operation Monitoring

In addition to the air monitoring specified in Section 4.1, GES unit operation and source gas (perimeter pipe) monitoring will be performed during gas extraction and treatment at Pond 15S. The monitoring described in this section is in addition to the gas extraction and treatment system(s) operational monitoring described in Section 3.2.4.

4.2.1 Pond 15S GES Unit Tailgas PH3 Monitoring

Each gas extraction and treatment system (GES) will be monitored to ensure that the tailgas (discharge of the treatment system) remains below 0.3 ppm PH3. In order to ensure GES tailgas compliance, the tailgas will be monitored regularly for concentrations of PH3 with a hand-held Draeger Pac III (or Draeger PAC 7000) meter (0 to 20 ppm range). This will be performed by holding the Draeger Pac III meter sample inlet in the tailgas discharge stream at least three times per operating shift during operation of the GES unit. The tailgas PH3 concentration will be recorded on the operator logsheet immediately after each reading.

4.2.1.1 Tailgas Sampling Procedure during Normal Operation

Normal operational periods are those during which the system is operating steadily at the intended capacity. These are periods when it would be expected that the GES unit is performing relatively consistently over time. As stated above, during these periods, tailgas monitoring will be conducted three times per operating shift. The monitoring procedure is as follows:

- Ensure that the Draeger Pac III (or Pac 7000) is setup with the 0 to 20 ppm hydride gas sensor (measures PH3 and similar compounds) sensor and has warmed up for at least 15 minutes.
- Ensure that calibration is current, as indicated by the sticker placed on meter during most recent calibration (instruments calibrated every two weeks).
- Check work area for PH3 leaks and continue monitoring throughout the sample collection activities. If PH3 leaks are observed, move upwind, document the observed PH3 leak and call the supervisor to complete a PH3 investigation and associated maintenance actions. Re-start sampling (i.e., re-collect the sample that was interrupted by detection of the leak) when conditions are suitable for sampling.
- Hold PH3 monitor with its sensor directed into the GES unit tail gas stream (i.e., exhaust pipe from second drum).
- Record stable PH3 concentration reading.

During routine operational periods, operators will make adjustments to the process if any tailgas reading exceeds 0.20 ppm PH3. This “action level” provides a buffer of another 50 percent increase in discharge concentration before reaching the maximum of 0.3 ppm PH3, which is the OSHA 8-hour PEL.

4.2.1.2 Tailgas Sampling Procedure during Non-Routine Operation

Non-routine periods of operation cover, at a minimum, the following circumstances:

- Initial system start-up
- New carbon vessel conditioning period following carbon change-out
- Operation during which process gas contributions and/or inlet PH3 concentrations to the treatment system are significantly changed or increased

During non-routine operational periods, the system requires additional monitoring in order to ensure that the tailgas PH3 concentration remains below 0.3 ppm. With respect to conducting PH3 tailgas concentration measurements, the operator(s) will follow the same procedure that was described in Section 4.2.1.1. However, because of the somewhat transient nature of non-routine operations, readings will be taken more frequently after a process change until the system is steadily operating at the intended capacity. For example, after a carbon change-out and the new carbon vessel is brought on-line, tailgas will be monitored at least once an hour until the carbon is determined to be conditioned. The typical procedure to condition carbon after a carbon change is to run the system on fresh air only for at least 2 hours to allow the carbon to warm to operating temperatures. Then PH3 is introduced to the system at a reduced level, typically 100 ppm to the inlet of the first carbon drum. After acceptable performance is demonstrated at the reduced PH3 level the concentration is slowly increased to the target inlet concentration of 300 ppm. This start-up period may require 6 to 24 hours total time to achieve normal operation. As described for routine operation, during non-routine operational periods such as after a carbon change-out, operators will make correctional adjustments to the process if any tailgas reading exceeds 0.20 ppm PH3. This “action level” provides a buffer of another 50 percent increase in discharge concentration before reaching the maximum of 0.3 ppm PH3, which is the OSHA 8-hour PEL.

4.2.2 Pond 15S Perimeter Piping Gas PH3 Monitoring

During the operational phase, ongoing operational data from the GES unit(s) will be collected and used to calculate and track the PH3 concentration in the perimeter pipe stand pipe(s) (i.e., the source gas PH3 concentration).

Should the GES unit operational data indicates the perimeter pipe PH3 concentration has decreased to below 2,000 ppm, a sample of GES inlet gas will be measured using the calibrated dilution manifold box method to confirm the perimeter pipe source gas concentration is below 2,000 ppm at both the east and southwest standpipes.

Following ceasing gas extraction and treatment per the criteria in Section 3.3, perimeter pipe monitoring will revert to quarterly. If, based on quarterly perimeter pipe monitoring, the PH3 concentration in one or more standpipes is greater than 2,000 ppm, perimeter pipe monitoring will be performed monthly until the perimeter pipe PH3 concentrations return to below 2,000 ppm. When perimeter pipe PH3 concentrations are below 2,000 ppm, monitoring will be quarterly.

4.2.2.1 Sampling Train Calibration Prior to the Perimeter Piping Monitoring Event

Calibrate Draeger Pac III PH3 Monitor: The Draeger Pac III field monitor[1] (0 to 1,000 ppm) will have been calibrated with 500 ppm PH3 standard calibration gas within 14 days prior to any perimeter piping monitoring event.

Calibrate Sample Train Dilution Box: Also, within 14 days prior to any perimeter piping sampling event, the sampling train dilution box will be calibrated using 500 ppm PH3 standard calibration gas and using various dilution ratios (N2 to PH3) to confirm the accuracy of the dilution box.

To avoid release of PH3 to the environment, the PH3 calibration gas used in this calibration procedure will be collected in a Tedlar bag. The Tedlar bag will then be discharged to an operating GES for treatment prior to release to atmosphere.

The perimeter piping sampling train calibration procedure follows:

1. Calibrate the Draeger Pac III PH3 monitor.
2. Position perimeter piping sampling train in the sampling lab. The equipment includes:
    - Gas dilution manifold
    - High-range (0 to 1,000 ppm) Draeger Pac III PH3 monitor equipped with a Draeger calibration cap.
    - Nitrogen gas cylinder for sample dilution
    - PH3 calibration gas cylinder (500 ppm)
    - Tedlar bag for the collection of gas discharged from the Draeger Pac III monitor.
    - Mass flow meters in the dilution manifold indicate the flow rate of calibration gas and dilution gas (nitrogen). The combined total flow of the PH3 calibration gas and any nitrogen dilution gas should be approximately 500

[1] Draeger has discontinued manufacturing the Pac III monitors but according to a Draeger representative they will continue to provide sensors and basic repairs for the Pac III. The Pac III is being replaced by the Draeger Pac 7000 for the low range PH3 sensor (0 – 20 ppm) and the by the X-AM 5000 for the high-range PH3 sensor (0-1,000 ppm). FMC may utilize the Pac III, Pac 7000, X-AM 5000 or equivalent monitors for the gas monitoring program.

SCCM. This is the flow for which the Draeger Pac III calibration cap is designed.

3. Connect the nitrogen dilution gas to the designated flow meter on the dilution box.
4. Connect the PH3 calibration gas to the designated flow meter on the dilution box.
5. Connect the Draeger Pac III PH3 monitor (0 to 1,000 ppm range) to the discharge line from the dilution box.
6. Connect the exhaust tubing from the Draeger Pac III PH3 monitor calibration cap to the inlet port of a Tedlar bag. Open the inlet valve on the Tedlar bag.
7. Begin dilution box calibration by opening the valve to the PH3 calibration gas line only and start sampling using only calibration gas at a flow of approximately 500 SCCM. After the Draeger monitor reading has stabilized, record the base line PH3 concentration.
8. Repeat the previous step using both PH3 calibration gas and nitrogen dilution gas connected to the dilution box. Adjust the flow rates of both the PH3 calibration gas and nitrogen dilution gas to ratios of approximately 0.5:1, 1:1, 2:1, and 3:1. Record the flow rates. The total gas flow of PH3 calibration gas and nitrogen dilution gas should be approximately 500 SCCM (specified by Draeger for their PH3 monitors). Record the Draeger monitor PH3 concentration for each dilution ratio.
9. After the calibration is completed, close the valve to the PH3 calibration gas line and disconnect the line. Allow the nitrogen dilution gas to run until the sampling equipment has been purged into the Tedlar bag.
10. After the sampling equipment is purged, then close the valve to the nitrogen dilution gas and disconnect the line. Close the Tedlar bag inlet. (The contents of the Tedlar bag must be discharged back into an operating GES unit.)
11. Calculate the source gas concentration using data collected from Step 9.

    Calculated source gas concentration = (Draeger reading) x [(N2 flow + PH3 flow) / PH3 flow].

12. Compare the calculated source gas concentration with the baseline concentration and compute % error.

    Error = [(Calculated source gas ppm – Baseline ppm) / Baseline ppm] x 100

13. If the average % error is less than 5%, then the dilution box calibration is complete and the perimeter piping sample train is considered to be within acceptable tolerance limits.

4.2.2.2 Perimeter Gas Collection Piping PH3 Sampling Procedure using Dilution Box

The procedure for measuring the east perimeter pipe standpipe PH3 concentration using the dilution manifold box method is described below.

1. Position the gas sampling train near the perimeter pipe sampling port. The sampling train consists of:

    - GeoTech peristaltic sampling pump
    - Gas dilution manifold assembly
    - High-range (0 to 1,000 ppm) Draeger PAC III PH3 monitor equipped with a Draeger calibration cap.
    - Nitrogen gas cylinder for sample dilution
    - Discharge tubing connected to the dilution air inlet or a tedlar bag for collection of the sampled pond gas

2. The gas dilution manifold should always be used in the perimeter piping gas sampling train. However:

    a) If the PH3 measurement from the perimeter piping is expected to be below 1,000 ppm (the limit of the high-range Draeger PAC III PH3 monitor), then the pond gas can be sampled directly through the dilution/mixing manifold without any dilution.
    b) If the PH3 concentration is expected to be above 1,000 ppm, then the pond gas will be diluted with nitrogen using the dilution manifold as appropriate to ensure the diluted sample PH3 concentration is below 1,000 ppm.

3. Mass flow meters in the dilution/mixing manifold indicate the flow rate of pond gas and dilution gas (nitrogen). The combined total flow extracted from the perimeter piping plus any dilution gas should be approximately 500 ml/min. This is the flow for which the Draeger PAC III calibration cap is designed.

4. Connect the suction side of the GeoTech sampling pump to the appropriate sampling port. Connect the discharge side of the GeoTech sampling pump to the designated dilution/mixing manifold mass flow meter (this is the pond gas containing PH3 to be measured).

5. Connect the nitrogen dilution gas, if required, to the designated flow meter on the manifold.

6. Connect the Draeger PAC III 0 to 1,000 ppm PH3 monitor properly to the discharge line from the dilution/mixing manifold.

7. Position the exhaust tubing from the Draeger PAC III PH3 monitor calibration cap to the inlet port of the eductor feeding the GES. This will ensure the expelled gas is treated through the GES prior to discharge.

8. Begin sampling pond gas by opening the sampling valve to the perimeter piping sample train and start the sampling pump.

9. Adjust the flow rates of pond gas and the nitrogen gas (if needed) through the dilution/mixing manifold flow meters as required to meet the appropriate dilution ratio. The total gas flow of pond gas and nitrogen dilution gas should be approximately 500 ml/min (as specified by Draeger for their PH3 monitors).

10. Monitor the digital display of the Draeger PAC III PH3 monitor. When the PH3 readings have stabilized, record the Draeger monitor PH3 readings, the dilution/mixing manifold gas flow rates, and the calculated PH3 concentration corrected for any dilution.

11. Record 3 consecutive data sets, about 10 minutes apart. Record the data on the perimeter piping sampling log sheet. Calculate the average from the 3 data sets.

12. After the sampling is completed from the perimeter piping, close the sample port valve and disconnect the sample hose. Allow the sample pump to run on fresh air until the sampling equipment has been purged into the eductor inlet port feeding the GES.

13. After the sampling equipment is purged, then turn off the sampling pump.

4.3 DATA ANALYSIS AND REPORT PREPARATION

GES unit operational status and monitoring and operational data will be reported in the weekly/monthly UAO reports.

4.3.1 Report Content and Submittal

The operational status and monitoring activities will typically be reported in the UAO weekly reports. The weekly reports will include the following:

- Operational status during the reporting week;
- Tabulated continuous monitoring data for the current week; and,
- Problems encountered and solutions proposed/implemented.

In addition to the above information, the monthly UAO reports will include:

- Monitoring results;
- Summary of process operational parameters; and,
- Operational objectives and any recommendations for changes to the GES unit operating schedule and/or deployment of GES units during the upcoming month.

Table 4-1 Phosphine Monitoring Schedule for Pond 15S

Perimeter Pipe PH3 Concentration Range[1]	Monitoring Program and Schedule				Response If Appurtenance AA and LD reading ≥ 0.05 ppm and/or Inside ≥ 1.0 ppm; and/or perimeter surace scan reading ≥ 0.05 ppm	Response If Inside Appurtenance Reading ≥ 10 ppm	Response If Appurtenance AA reading ≥ 0.30 ppm and/or LD reading ≥ 1.00 ppm and/or Inside Appurtenance reading ≥ 35 ppm
	Appurtenances	Perimeter Surface Scan	Perimeter Pipe	Continuous Monitoring			
During Gas Extraction and Treatment							
≥ 2,000 ppm	Monthly	Monthly	GES operational data - monthly average.	During periods of source gas extraction.	Perform maintenance and remonitor within 10 days and continue monitoring.	Perform maintenance and remonitor within 10 days and continue monitoring.	Perform maintenance and remonitor within 10 days. If remonitoring reading ≥ trigger levels, increase gas extraction PH3 mass removal rate.
Post Gas Extraction and Treatment							
< 2,000 ppm	Monthly	Monthly	Quarterly	Not applicable	Perform maintenance and remonitor within 10 days and continue monitoring.	Perform maintenance and remonitor within 10 days[2]. Perform perimeter pipe monitoring within 10 days. If perimeter pipe concentration in higher range, implement monthly monitoring.	Perform maintenance and remonitor within 10 days. Begin gas extraction and treatment within 10 days.
	If prior 12 consecutive months, AA and LD ≤ 0.05 ppm, monitoring quarterly.	If prior 12 consecutive months, scan results ≤ 0.05 ppm, monitoring quarterly.			Perform maintenance and remonitor within 10 days[2] and continue monitoring. If post-maintenance result ≥0.05 ppm, revert to monthly.		
	If prior 4 consecutive quarters, AA and LD ≤ 0.05 ppm, monitoring annually.	If prior 4 consecutive quarters, scan results ≤ 0.05 ppm, monitoring annually.			Perform maintenance and remonitor within 10 days[2] and continue monitoring. If post-maintenance result ≥0.05 ppm, revert to quarterly.		
2,000-9,999 ppm[3]	Monthly	Monthly	Monthly		Perform maintenance and remonitor within 10 days and continue monitoring.	Perform maintenance and remonitor within 10 days and continue monitoring.	

Appurtenance AA means Ambient Air and LD means Leak Detection.

(1) Based on highest PH3 concentration standpipe for ponds with multiple standpipes.

(2) If the "within 10 day re-monitoring" outside appurtenance reading(s) are less than 0.05 ppm and the inside reading(s) are less than 0.3 ppm, then remonitor one month from initial exceedance (if on quarterly or annual monitoring frequency).

(3) If perimeter pipe concentration > 9,999 ppm, re-initiate gas extraction and treatment within 10 days.

SECTION 5 SUMMARY OF PLAN AND SCHEDULE

In summary, the readily implementable plan for gas extraction and treatment at Pond 15S is as follows:

- Continue implementation of gas extraction at Pond 15S on a 12-hour per day, seven days a week (12/7) schedule using four GES units extracting at the southwest standpipe and one GES unit extracting from the east standpipe at Pond 15S.
- Implement (or continue to implement) the PH3 monitoring at Pond 15S as described in Sections 4.1 and 4.2.

As described in the Framework for Post-Closure Operation and Maintenance of RCRA Pond Gas Extraction and Treatment Systems (December 2012), the gas extraction and treatment approach as described above on Pond 15S standpipes operating on a 12/7 schedule will achieve a minimum monthly-averaged PH3 mass removal rate of 6 pounds per day (lb/day) provided the source gas PH3 concentration at the southwest standpipe remains above 2,000 ppm.

The operation of the GES unit may be modified over time, based on monthly average monitoring data, to increase or decrease the monthly-averaged daily PH3 mass removal rate. Following an initial period of GES unit operation to establish an extraction rate that yields a steady state source gas concentration, estimated to take 30-60 days based on initial extraction at Pond 15S and other ponds, adjustments will be made to maintain the perimeter pipe concentrations below 10,000 ppm. In addition, decreasing the monthly-averaged daily PH3 mass removal rate may be necessary to maintain efficient GETS operation, e.g., maintain 300 ppm inlet PH3 concentrations. FMC will notify EPA and obtain EPA approval prior to changing the GES unit operating schedule and/or deployment of GES units at Pond 15S.

Should the monthly GES unit source gas PH3 concentrations at both standpipes decreases below 2,000 ppm as measured using the dilution box method specified in Section 4.2.2, FMC will notify EPA and cease gas extraction and treatment at Pond 15S. Monitoring will continue pursuant to the then-applicable EPA-approved plan (e.g., this Readily Implementable Work Plan or an amended RCRA Pond Post-Closure Plan).

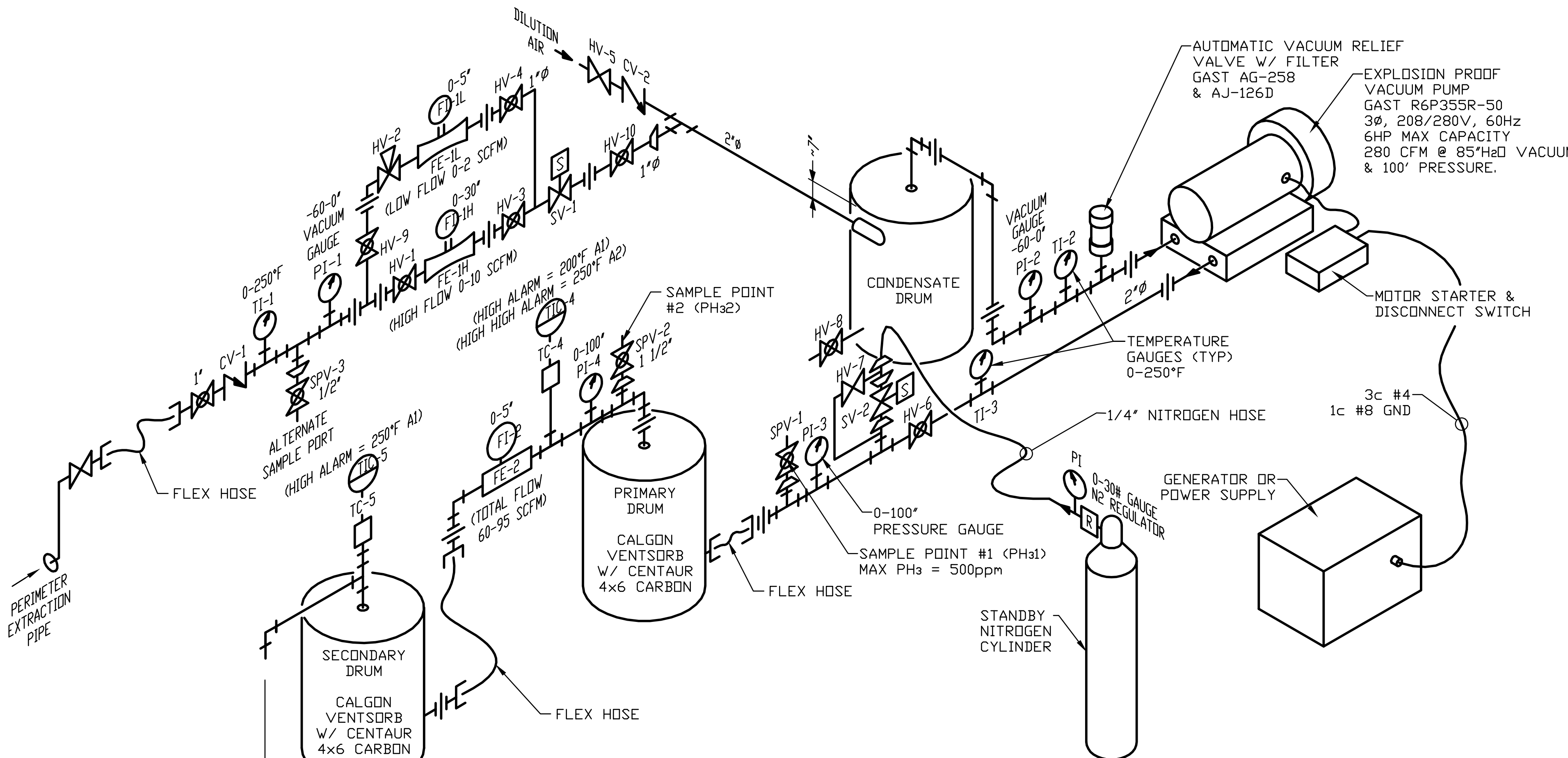


FIGURE 3-1

SCHEMATIC DIAGRAM
GAS EXTRACTION AND TRETMENT SYSTEM
FOR POND 18A
PERIMETER PIPE EXTRACTION

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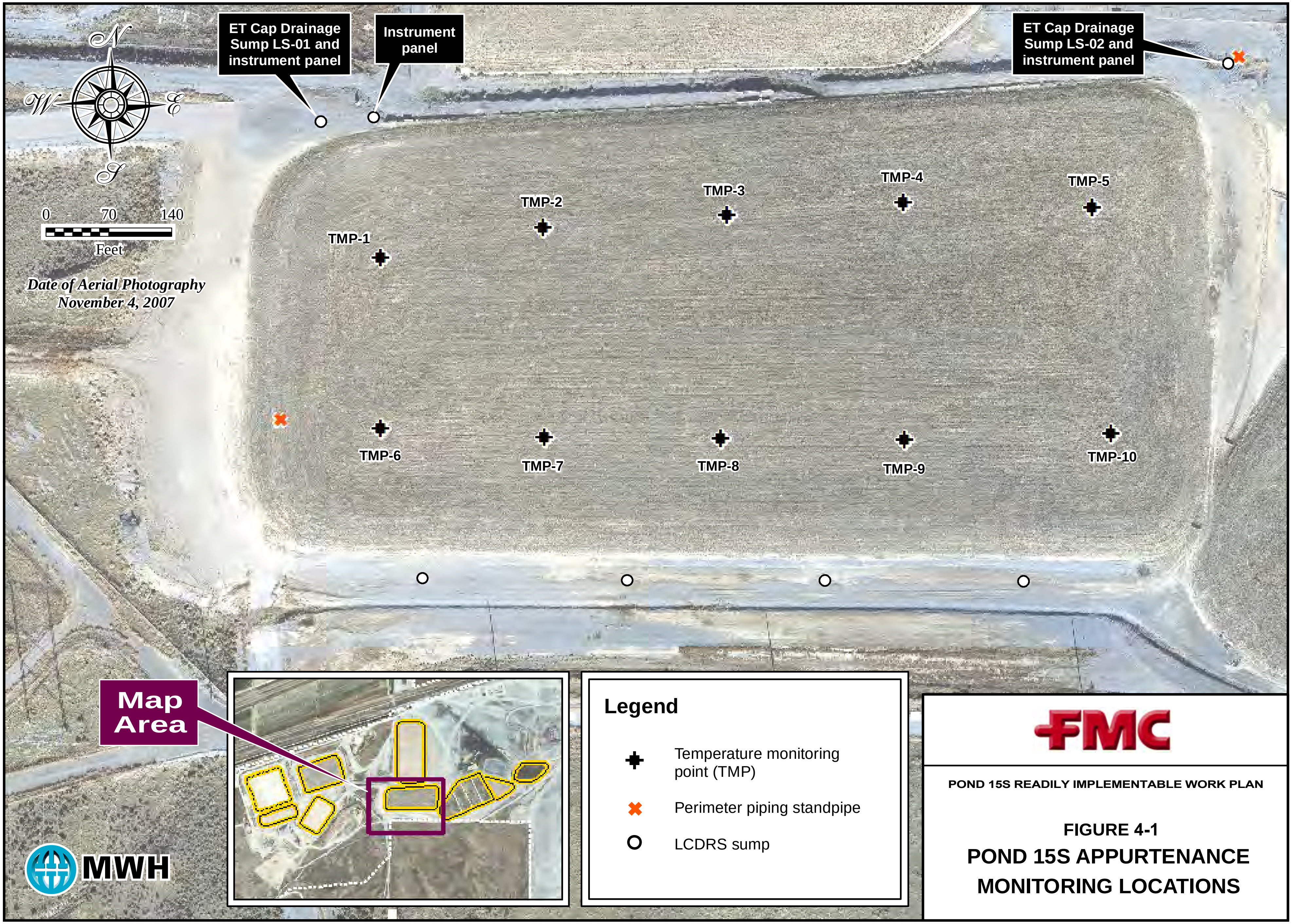

FIGURE 4-1
POND 15S APPURTENANCE MONITORING LOCATIONS

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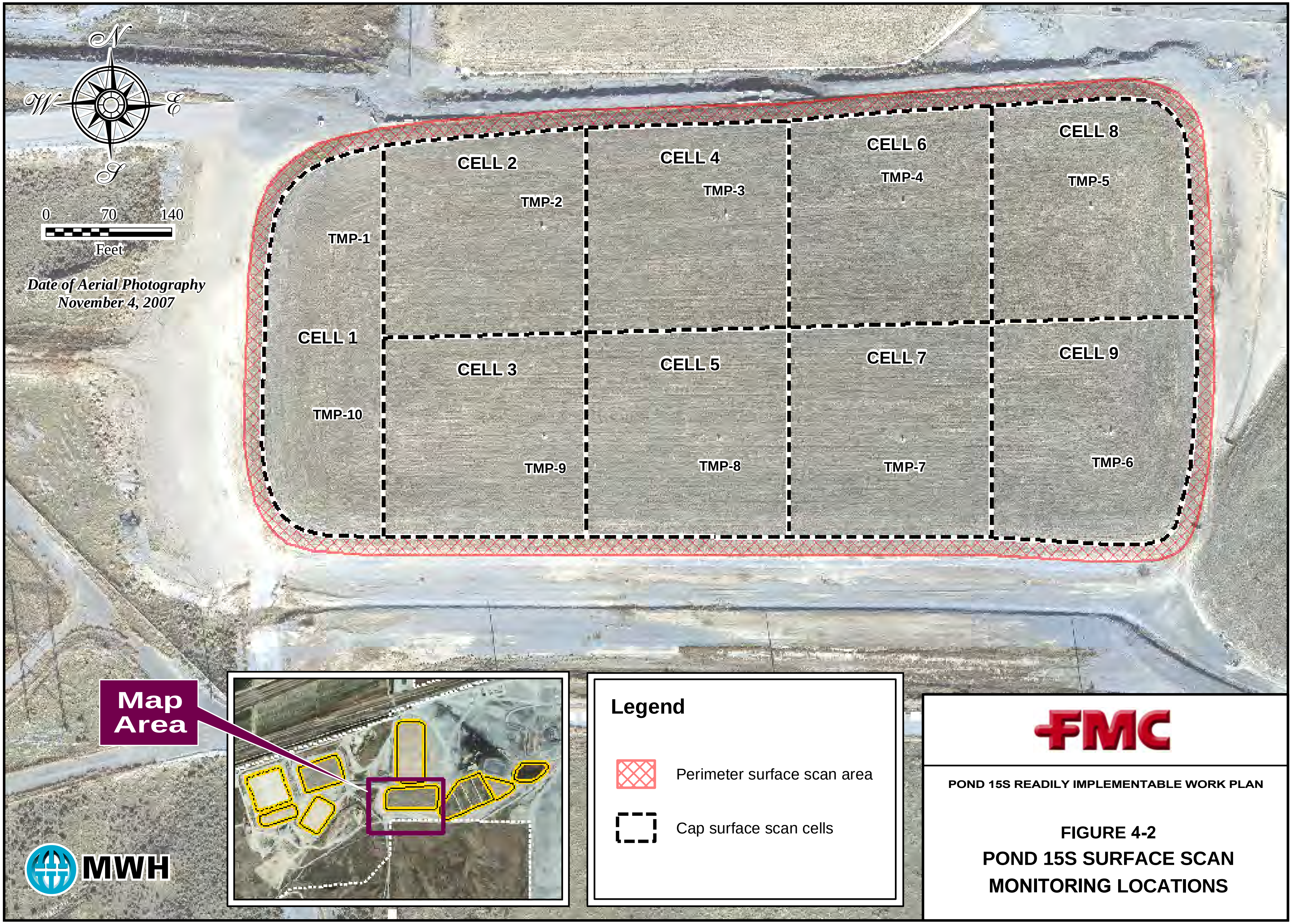

FMC

POND 15S READILY IMPLEMENTABLE WORK PLAN

FIGURE 4-2
POND 15S SURFACE SCAN MONITORING LOCATIONS

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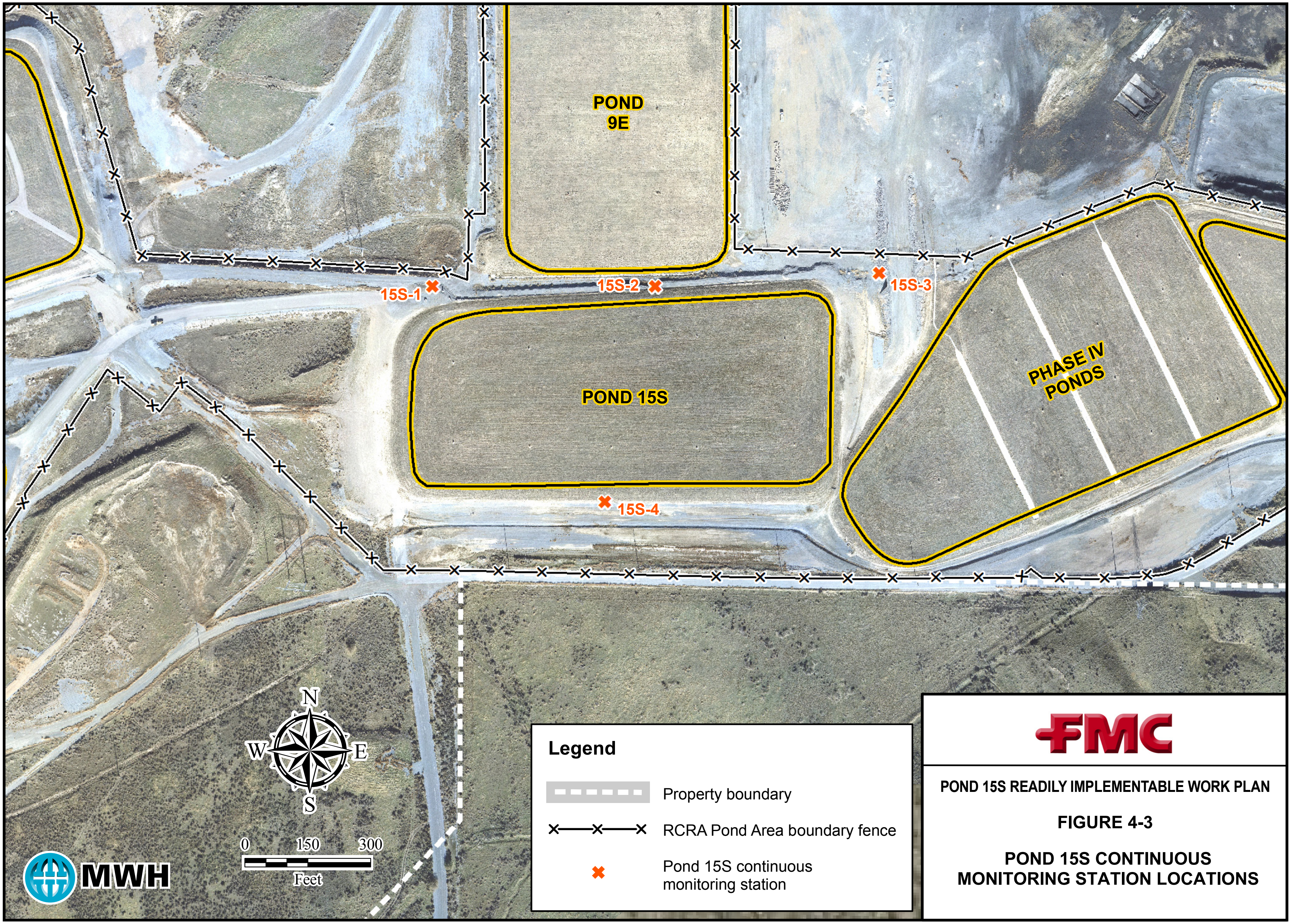
10 June 2014

DRAWN BY D. Severson



Legend

- Property boundary
- RCRA Pond Area boundary fence
- Pond 15S continuous monitoring station

FMC

POND 15S READILY IMPLEMENTABLE WORK PLAN

FIGURE 4-3

POND 15S CONTINUOUS MONITORING STATION LOCATIONS

Pond 15S Readily Implementable Work Plan

Appendix A

TMP Mechanical Drilling Procedure

TMP MECHANICAL DRILLING PROCEDURE

1. Complete Job Planning Safety Analysis (JPSA) for drilling of specific TMP:

   a. Identify potential job hazards.
   b. Prescribe appropriate monitoring during the procedure, i.e., PH3 monitoring.
   c. Prescribe appropriate PPE for employees performing procedure.

2. Prepare TMP for drilling:

   a. Remove TMP enclosure to provide access to TMP piping.
   b. Connect the mobile GES unit (with high-range flow meter) to the extraction connection on the TMP casing.
   c. Utilizing the sample port connection on the GES extraction piping, begin nitrogen purging into the TMP casing. Purge down the TMP until at least four conduit volumes have been purged through the TMP.
   d. Stop nitrogen purge and begin sweep gas flow using the mobile GES.
   e. Remove TMP thermocouple from TMP well. Note the length of the stainless-steel sheath removed from the casing.
   f. Continue sweep gas flow using the mobile GES.

3. Construct drill assembly:

   a. Build a drill assembly of the required length based on the length of the thermocouple sheath removed from the TMP well.
   b. The final section of the drill assembly must be the 12-inch drill adaptor rod designed to attach to the rotor-hammer drill.

4. Drill hole in bottom of TMP casing

   a. Insert drill assembly into ¾-inch thermocouple conduit.
   b. Accurately note the depth when the drill bit contacts the bottom of the casing.
   c. Attach rotor-hammer drill to drill bit adaptor assembly.
   d. Slowly begin drilling (whenever any binding is observed the drill will be reversed to relieve the binding).
   g. Track the drilling progress (It is expected that 2 to 3 inches of drilling will be required to completely break-through the drive cap bottom of the TMP casing).
   h. Stop drilling when break-through occurs. The design of the drilling coupling will prevent penetration beyond 10 inches below the drive cap.

5. Remove drill assembly from TMP well casing and observe the drill bit to determine bottom of drive cap condition (i.e. dry or wet).

6. Determine the TMP "max" flow capability:

   a. Install blind flange on the top flange of the TMP casing.
   b. Determine "max" flow capability utilizing the mobile GES.
   c. If desired extraction flow is possible then re-install TMP thermocouple (Step 7).
   d. If desired flow is not possible then it may be necessary to repeat Steps 2 thru 6.

7. Re-install TMP thermocouple:

   a. Shut off gas extraction through the mobile GES.
   b. Utilizing the sample port connection on the GES extraction piping, begin nitrogen purging into the TMP casing. Purge down the TMP until at least four conduit volumes have been purged through the TMP.
   c. Loosen bolts on blind flange on the top of the TMP.
   d. Re-establish the sweep gas flow utilizing the mobile GES.
   e. Remove the blind flange on the top flange of the TMP casing and re-install the TMP thermocouple with flange.
   f. Replace and secure the TMP enclosure.